January 1992/$3.00

Mobile Radio Technology

The journal of mobile communications technology



Battery maintenance, p. 10

Digitally coded squelch
Duplex operation curves
IMCE/Spring preview/guide

AN INTERTEC PUBLICATION

How to increase cellular system coverage or fill "black holes" – profitably and immediately.

New EXTEND-A-CELL® Cellular Booster and Repeater Systems.



Virtually every cellular system has potentially profitable areas where additional cell sites cannot be economically justified: urban black holes ... tunnels and buildings ... suburban zones on the fringe. Reaching these areas could mean an expanded customer base, increased air-time usage and decreased churn.



The solution? EXTEND-A-CELL cellular boosters and repeaters. They can solve coverage problems simply and inexpensively, capitalize on new service opportunities, and increase your competitive edge.

EXTEND-A-CELL systems work by picking up both voice and control signals from a "donor" cell, amplifying them and beaming them into the problem area. Simultaneously, they receive signals, amplify them and send them back to the donor cell. They are completely transparent to both the mobile and portable units, and to the cellular system. Subscribers in the boosted area operate just as if they were within the donor cell's normal coverage.



EXTEND-A-CELL systems are extremely compact and completely self-contained. They can be installed almost anywhere, tested and fully operational in a matter of hours.



EXTEND-A-CELL IV repeaters can cover an area equal to a conventional cell, plus can be located 30 miles or more from the donor cell.



EXTEND-A-CELL II low-power boosters can fill small holes up to two miles across and can be located up to six miles from the donor cell.

Built-in remote control, monitoring and alarm capabilities virtually eliminate the need for site visits. And EXTEND-A-CELL systems do not require you to revise your frequency re-use plan.

a member of the Allen Group Inc.

"Stripes of Quality"

the antenna specialists co.

30500 Bruce Industrial Parkway • Cleveland, OH 44139-3996
TEL: 216/349-8400 • FAX: 216/349-8407

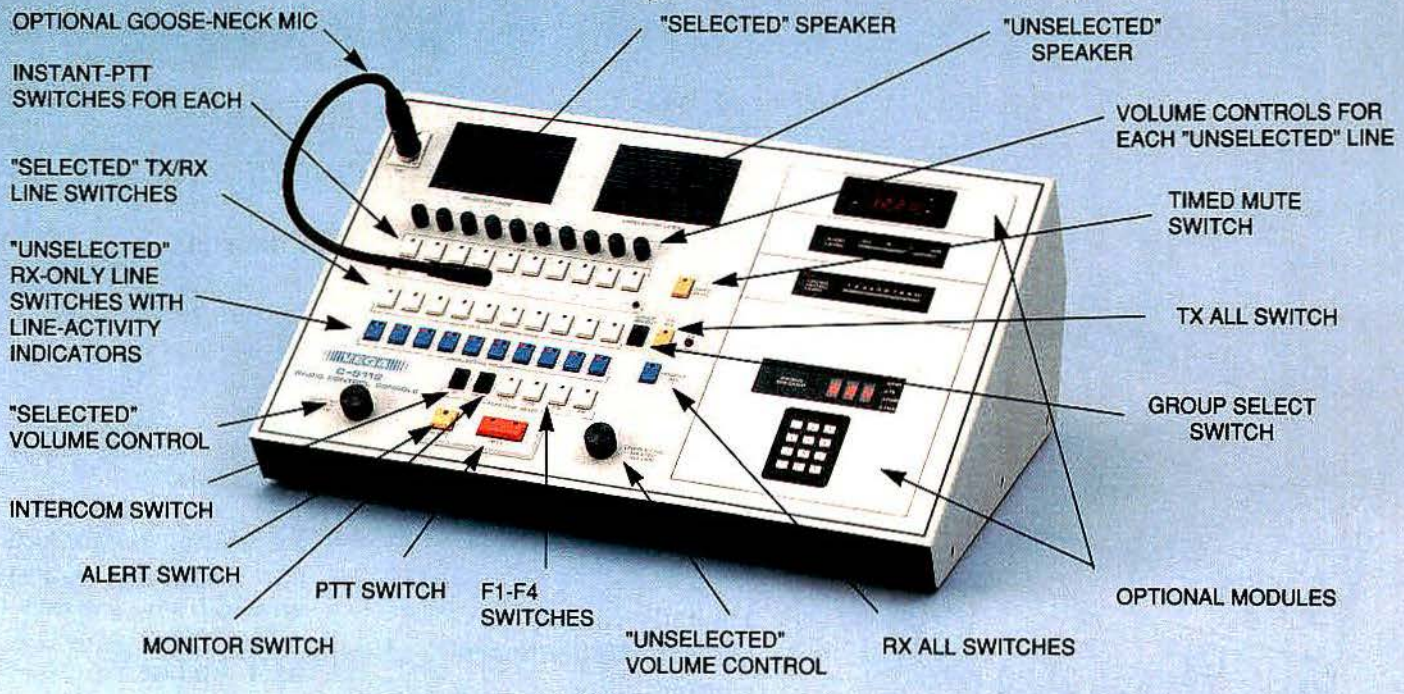
Circle (1) on Fast Fact Card



To learn more about how EXTEND-A-CELL systems can increase cellular system coverage and keep potential revenue from slipping into a black hole, send for our brochure.

© Copyright 1990 by The Antenna Specialists Co.

More Console, Less $$$



C-5112

Customizable features in an economical standard console

Do you need custom console features on a limited budget? Vega's Model C-5112 ten-line/four-frequency console offers the economy of a standard-production tone-format radio control console with the expandability of a custom design. External adapters are also available to convert any of the ten lines to DC control.

Just a few of the standard features (many usually optional even on larger, more expensive consoles), include:

- **"SELECTED" switches** for selecting any combination of lines for transmitting and receiving
- **"UNSELECTED" switches** for monitoring any combination of unselected lines
- **TX ALL (simulcast) switch** (selects all lines for both transmit and receive)
- **RX ALL switch** for monitoring all unselected lines
- **Separate speakers** and volume controls for "selected" (TX/RX) and "unselected" (RX-only) audio
- **GROUP SELECT** switch for easy selection of TX/RX line combinations
- **TIMED MUTE** switch (temporarily mutes "unselected" audio)
- **Separate volume controls** for each receive line
- **Instant-PTT switches** for each line
- **Line-activity LEDs** (indicate activity on each line, selected or not)
- **Panel-mounting option modules** (interchangeable options)
- **Heavy-duty 120/240-V_{ac} power supply** (also runs on 12 V_{dc})

Options

When you need just a few custom capabilities in a console, you don't have to buy an expensive, fully customizable design. With the C-5112 you can choose just what you need from the following list of economical options and "FX Series" function expansion modules:

- DCA-3 external three-line adapter for DC-format lines
- Audio-level display and 12/24-hour clock modules
- DTMF encoder module with 16-button pad
- Two-tone, five-tone, and Reach-format sequential encoder modules with pad and display
- Function-tone-generator module; adds eight "wild-card" function tones
- Cross mute with display module
- Goose-neck and desk microphones, headsets, footswitch, etc.

Future options are planned to include a cross-patch module, phone-patch module, telephone module, and ANI display. Other very specialized modules and options are available at reasonable prices. Consult Vega's Specials Department.

Call **1-800-877-1771** (toll-free) today for full details on the C-5112 console.

Circle (4) on Fast Fact Card

VEGA

a **MARK IV** company

Signaling Products Group

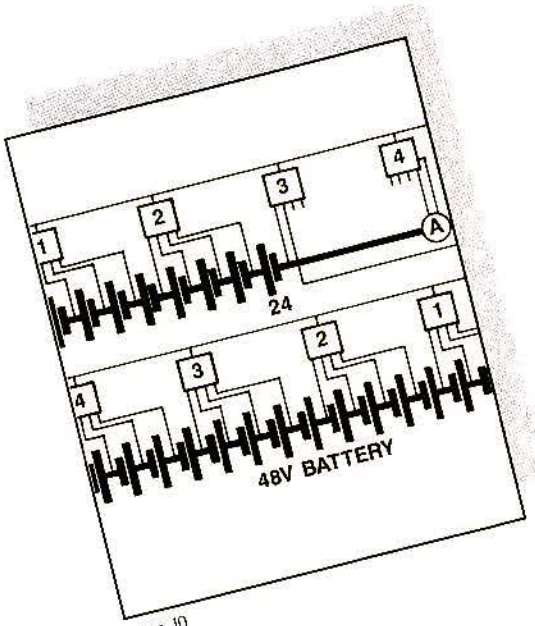
9900 Baldwin Place • El Monte, CA 91731-2204
(818) 442-0782 • 800-877-1771
Fax: (818) 444-1342

Contents

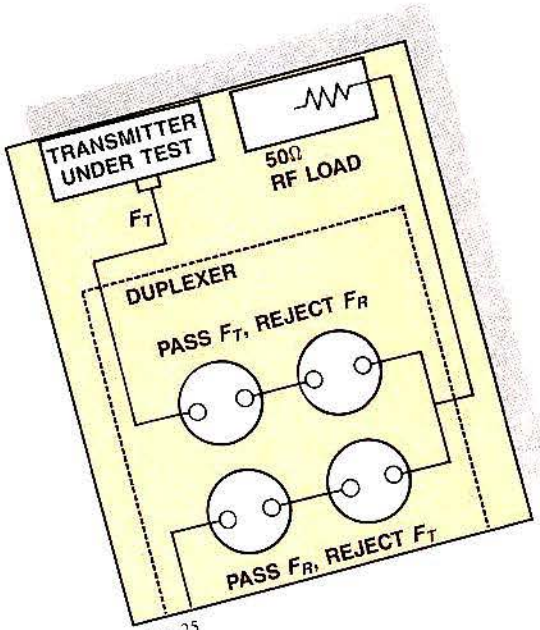
Mobile Radio Technology

Volume 10, Issue 1

The journal of mobile communications technology



page 10



page 25

features

10 Maintain station batteries with computer assistance
Lynn H. Hansen
Computerized evaluation improves maintenance of stationary batteries in mobile radio, microwave and other facilities to ensure emergency power availability and to reduce maintenance costs.

20 Digitally coded squelch: Radio/board compatibility
Mark Nadir
Part 3—This installment completes the discussion of noise and sampling, explains how your radio influences DCS performance and tells you how to evaluate software vendors that claim to have DCS expertise.

25 Curve measurements predict practical duplex operation
Ernesto A. Alvicar
Part 1—Use these step-by-step techniques with test equipment you are likely to have on hand in the shop.

32 IMCE/Spring show preview/guide
MRT staff
More than 300 mobile communications equipment manufacturers, distributors and service providers will convene at the Las Vegas Convention Center, and many exhibitors will debut new products and services as they gear up for 1992.

On the cover: Stationary batteries power a central office facility in Milwaukee. Photo courtesy of the battery manufacturer, Johnson Controls, Milwaukee. See article on page 10.

departments

4 Editorial

6 Letters to the editor
Marine radio servicing.

66 News
Computers making inroads in land mobile.

70 Regulating technology
FCC engineers, specialists strive to resolve interference.

74 ACT update

76 New products
CPI Communications, Falkner & Associates and Lightning Master are the "Readers' choice."

83 Literature

84 Feedback
Maintaining equipment obtains high rating.

86 People

87 Calendar

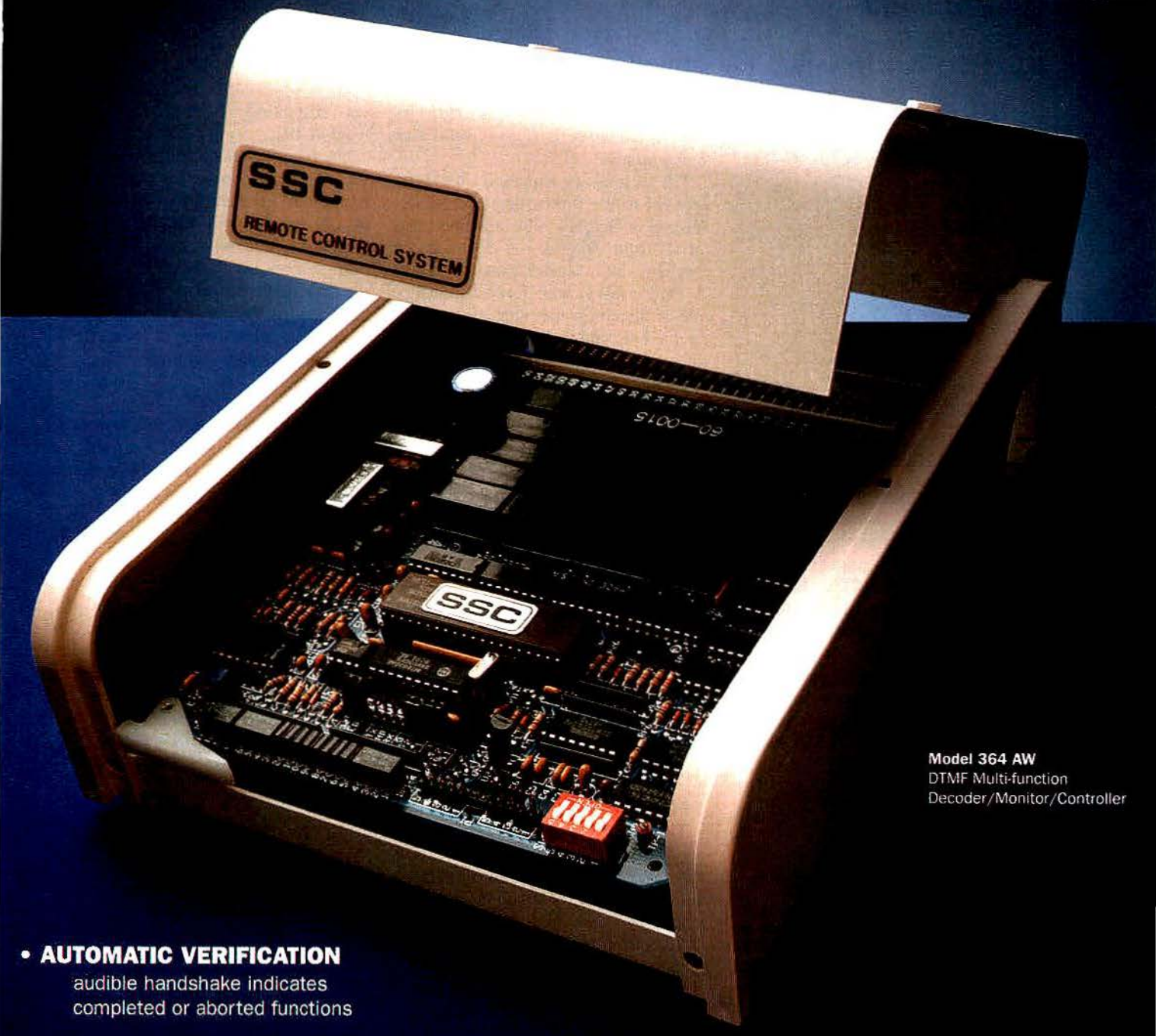
88 Classified ads

104 Ad index/hot line
Find advertisers quickly.

105 What do you think?
Do you prefer crystal-controlled or synthesized radios?

©1992 Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9221 Quivira Road, Overland Park, KS 66215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66282-2960.

A New Generation of Response Signalling...



Model 364 AW
DTMF Multi-function
Decoder/Monitor/Controller

- **AUTOMATIC VERIFICATION**
 audible handshake indicates completed or aborted functions
- **EASY STATUS INTERROGATION**
 a touch-tone pad, voice channel and your ear is all you need
- **SYSTEM MONITORING**
 audible alarms will automatically signal critical conditions
- FREE **SSC APPLICATIONS SUPPORT**
 experienced personnel will help you find the best solution for your users
- **MICROPROCESSOR FLEXIBILITY**
 wide range of available controls (latched, timed, momentary, interlocked, etc.)
- **STRAIGHTFORWARD USER SELECTION**
 complete manual with tutorial, demo set-up and helpful systems feedback
- **PROVEN RELIABILITY**
 fully field-tested and FCC certified (class A) plus our established 5 year warranty

Call now for full information package:

800-227-1226

One source for all your signalling needs

SSC **SOLID-STATE COMMUNICATIONS, INC.**
21060 Corsair Boulevard
Hayward, California 94545

Circle (5) on Fast Fact Card

220MHz: Battleground for competing narrowband technologies



Proponents of various narrowband technologies are looking to carve out a share of 220MHz equipment sales.

Narrowband technology long has been a front-runner when it comes to discussions about dividing the 2MHz-wide slice of spectrum.

Early manufacturers of narrowband two-way radios produced amplitude companded single-sideband (ACSSB) equipment that suppresses the carrier wave and transmits a pilot tone above the voice frequency baseband. This tone-above-band (TAB) equipment confines the radio emission to a 5kHz-wide channel. FM, in comparison, occupies channels from 12.5kHz wide to 30kHz wide.

TAB equipment has been made for use on 150MHz two-way radio frequencies, and it continues to be made. Many of the eventual 220MHz-band licensees are likely to purchase TAB equipment expected to be built for the new band.

Meanwhile, at least two other contenders may challenge the established TAB technology: real zero single-sideband (RZSSB) and transparent tone-in-band (TTIB) amplitude companded single-sideband.

RZSSB

What has become an RZSSB demodulation technique was described in part by an AT&T Bell Laboratories researcher in 1977. A more fully developed approach was described in 1986 by several NTT Electrical Communications Laboratories researchers, whose paper was printed in the Institute of Electrical and Electronics Engineers (IEEE) *Transactions on Vehicular Technology*.

The technology apparently has been brought to the prototype stage, as described in October 1991 in printed material from Martek, a company in Durham, NC. Martek president Hans A. Marosfalvy, who formerly headed one of the companies that makes TAB equipment, said that he could tell us little more than what his news release reveals.

Nevertheless, the IEEE paper and consultations with other people familiar with RZSSB indicate that RZSSB technology is a new reception technique for single-sideband (SSB).

Most SSB receivers re-insert a carrier wave to demodulate the SSB signal with AM techniques. The inserted carrier replaces the carrier that is suppressed before the signal is transmitted.

In an RZSSB system, a reduced carrier is transmitted along with the SSB signal. The RZSSB receiver demodulates the SSB signal with a method similar to FM demodulation techniques, after first amplifying the received carrier to full strength.

TTIB

Through the years, the TTIB variation of ACSSB technology has been described at numbers of trade association and professional society meetings attended by Professor Joseph McGeehan and his associates from the University of Bristol in the United Kingdom.

With TTIB, the pilot tone is transmitted near the center of the baseband audio spectrum. Baseband audio is notched out of the tight band of frequencies surrounding the pilot tone, so the tone is not heard by the listener.

We would be surprised if equipment offered for use at 220MHz did not include TTIB radios. In fact, it seems more likely that TTIB equipment will join TAB equipment in the marketplace before RZSSB equipment does.

Competition

The two companies that already have been making TAB equipment for many years might have hoped for a less competitive marketplace once the 220MHz band was opened to land mobile radio, yet restricted to narrow channel bandwidths.

On the other hand, an engineer familiar with the technologies said that the additional competition may improve overall sales. He reasoned that prospective buyers may take narrowband technology more seriously when they have the opportunity to compare two or more methods. He said buyers may prefer the sound and performance of the technology he advocates—naturally.

Standards

It will not be long before someone will find fault with the competition among technologies and will propose that standards be set. Maybe it will happen before the first 220MHz licenses are granted and before the first 220MHz equipment is sold.

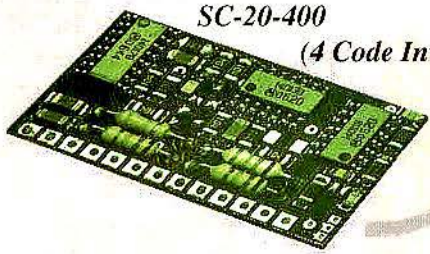
The relative merits of competition and standards stimulate discussion with the advent of every new technology. The seeds of such discussion already were planted in public comments filed with the FCC in the 220MHz band proceeding. We will be interested to see who calls the first standards meeting.

—Don Bishop

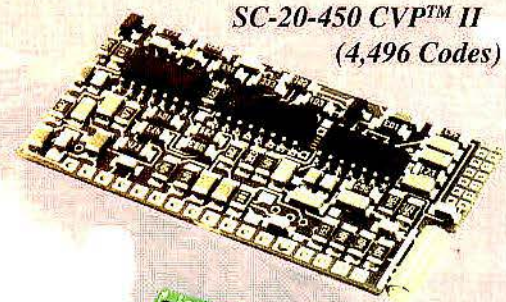
transcrypt / international

the innovators in communication technology

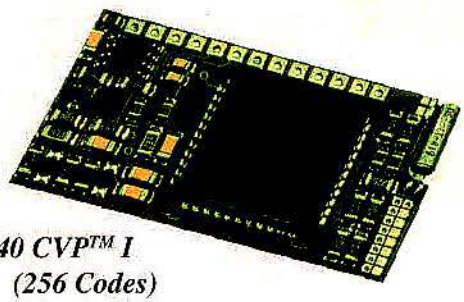
NOBODY SCRAMBLES BETTER



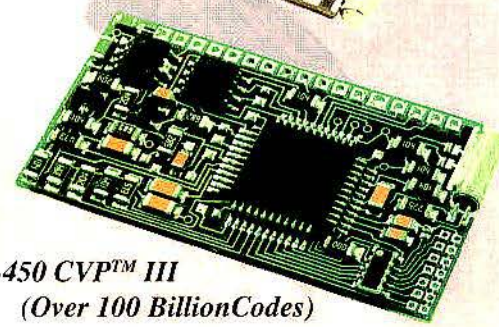
SC-20-400
(4 Code Inversion)



SC-20-450 CVP™ II
(4,496 Codes)



SC-20-440 CVP™ I
(256 Codes)



SC-20-450 CVP™ III
(Over 100 BillionCodes)

The ultimate scrambler from the number one company in scrambling for two-way radio and cellular phones

Crypto Voice Plus is an approved standard across the world and is fully compatible with over 900 radio makes and models. A complete range of universal and custom modules are available to meet your security and system requirements.

CVP™ scramblers incorporate a unique combination of digital control and narrow band analog audio frequency modification. The result is clear, natural sounding speech and excellent voice recognition. Range and audio quality are not effected as they are in plain digital systems, and no special base or repeater equipment is required.

Transcrypt International is committed to on going innovation and leadership in radio communications and cellular voice privacy. Transcrypt customers receive a wide range of services, including factory installation, application notes, and experienced technical support.

Our end-to-end system solutions are providing reliable service in tens of thousands of systems worldwide. For quality, experience and your peace of mind,

Transcrypt is number one

Circle (6) on Fast Fact Card

Order Toll Free (800) 228-0226

transcrypt / international

1620 North 20th Street, Lincoln, NE 68503 Phone (402) 483-2961 Fax (402) 435-6780

Letters to the editor

Marine radio servicing:

The article in the October 1991 issue on marine radio servicing, although generally informative, left out one important detail. Any technician who services marine radios or radars must possess an FCC General Radiotelephone License with a radar endorsement. A NABER certificate will not do and could lead to fines and other problems for the technician who performs the service without the necessary license.

Our company does both land mobile and marine service, but all our service engineers hold FCC licenses.

Richard Beck
Chief Engineer
Honor Marine Communications
San Diego

Your article in the October 1991 issue suggesting the natural extension of land mobile servicing to include marine servicing was good. As electronic manufacturers continue to improve the quality and reliability of their products, those of us in the electronic service industry must continually scan the horizon to find newer service avenues that will fit comfortably into our particular service operation.

You did, however, omit one important bit of information: To service marine radios requires an FCC license and to service radar requires a radar endorsement. You may be well aware of this requirement, but many newcomers to the land mobile servicing business (where a license is not required) may not. A license still is required to service marine and aircraft radios, just to name a few. There are many others.

I have been in the land mobile and marine sales and service business for more than 37 years, and I want you to know that I find your publication to be one of the best. I find your technical articles to be both helpful and informative. In these days of rapidly changing technology, we need all the help we can get.

I appreciate your magazine and your efforts. Keep up the good work.

L.J. Patterson
Patterson Communications
& Electronics
Biloxi, MS

Paging interference:

You were right on point in your November Editorial concerning private carrier woes. Interference problems on private carrier paging (PCP) channels, particularly on the high-power VHF channels, have been an ongoing, sometimes devastating problem in the industry. However, relief is in sight.

The Association for Private Carrier Paging (APCP), a membership section of the National Association of Business and Educational Radio (NABER), has filed a Petition for Rulemaking with the FCC. The petition requests certain rule changes that will enable PCP licensees to operate in an efficient and interference-free environment.

Mobile Radio Technology
The journal of mobile communications technology

EDITORIAL
Don Bishop, *Editorial Director*
Jane Bryant, *Staff Editor*
Nancy Campbell, *Associate Editor*
Jeri Robinson, *Paste-up Artist*

INDUSTRY CONSULTANT
Fred M. Link

REGULATORY CONSULTANT
Alan S. Tilles, Esq.; *Partner; Meyer, Faller, Weisman & Rosenberg P.C., Washington, DC*

EDITORIAL ADVISORY BOARD
Gene A. Buzzi, *President, Omnicom Telecommunications Engineering, Tallahassee, FL*
R. James Evans, *Communications Consultant, East Lansing, MI*
Gary David Gray, P.E., *Chief Telecommunications Engineer, Orange County Communications, Orange, CA*
Frederick G. Griffin, P.E., *President, Frederick G. Griffin P.C., Lynchburg, VA*
S.R. McConoughey, P.E., *Mobile Communications Consulting, Gaithersburg, MD*
Art McDole, *Salinas, CA*
F. Stuart Meyer, *Land Mobile Consultant, Vienna, VA*
Don R. Precure, *New Smyrna Beach, FL*
Herb Sachs, *Herb Sachs Consulting, Bowie, MD*
Leon Spencer, *Radio Engineering Systems, Exxon Company USA, Houston, TX*
Dr. Gregory M. Stone, *Vice President, Special Projects, Live Oak Systems, McLean, VA*
Raymond C. Trott, *President, Raymond C. Trott Consulting Engineers, Irving, TX*

BUSINESS
Cameron Bishop, *Group Vice President*
Mercy Contreras, *Publisher*
Darren Sextro, *Marketing Director*
Evelyn Hornaday, *Promotions Manager*
Margaret Sullivan, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Mary Birnbaum, *Advertising Production Supervisor*
Liz Turner, *Advertising Coordinator*
Lisa Cunningham, *Classified Advertising Coordinator*
Tom Cook, *Group Senior Managing Editor*
Czatdana Inan, *Group Director of Special Projects*

ADMINISTRATION
R.J. Hancock, *President*
Sandra Stewart, *Corporate Circulation Director*
Cindy Cardinal, *Circulation Director*
Christine Lotesto, *Circulation Manager*
Customer Service, *(913) 541-6628*

ADVERTISING: Northeast: Ruth Breashears, 303-762-1249; West Coast: Dennis Hegg, 415-491-1442; South: Diane Hite, 303-762-1249; Midwest: Nancy F. Matthews, 312-435-2340; Classified: Carla Gamino, 303-762-1249.

CORRESPONDENCE: Editorial and advertising correspondence should be addressed to P. O. Box 12901, Overland Park, KS 66282-2901, 913-888-4664, telex: 42-4156 INTERTEC OLPK, fax: 913-541-6697.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' representatives, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge in the United States by name and title to personnel who are responsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are $30 per year; In Canada, $36 per year; and in other countries, $40 per year. Foreign airmail optional at an additional $65 per year. Single copies are $3 plus postage and handling; back issues, $5 postpaid. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription. Send subscription information to: P.O. Box 12968, Overland Park, KS 66282-2968.

PHOTOCOPY RIGHTS: Permission to photocopy for internal or personal use is granted by Intertec Publishing Corporation for libraries and others registered with Copyright Clearance Center (CCC), provided the base fee of $2 per copy of article is paid directly to CCC, 21 Congress St., Salem, MA 01980.

VBPA ABP
Audited circulation.

$3.00 + 0.00

INTERTEC PUBLISHING

©1992 by Intertec Publishing.
All rights reserved.

We put control in YOUR hands.

The best features, in the right products.

800/860
Two-Way Handsets

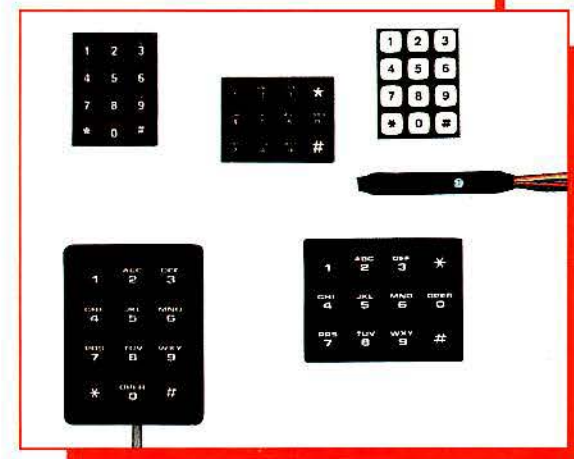
- Telephone style encoder handset with cradle.
- Adds privacy to calls in vehicle.
- Adapts to most all underdash mount radios.
- Available in manual or auto dialing models.
- Backlighted silicon rubber keypad.
- On or off cradle dialing.
- Radio speaker mutes when off hook.



810 Premier Microphone

- Water, dust, and shock resistant.
- Backlighted silicone rubber keypad with tactile feel pushbutton operation.
- All options are keypad programmable.
- 20 number memory dialer, auto ANI connect & disconnect operation, last number redial.
- Fourth column tone accessed from keypad.
- Oversize keys for gloved hand operation.
- Extra heavy duty coiled cord.
- Externally adjustable level settings.





710 Processor Controlled

- Store and send dialing, or manual dialing
- Eight autodial locations, up to 21 digits each.
- Auto ANI encoding of up to two 21 digit DTMF codes.
- Backlighted silicone rubber alphanumeric keypad.
- Nonvolatile EEPROM memory.
- True audible DTMF sidetone.
- High strength 7′ coiled cord.



Encoders

- Miniature size, mount anywhere.
- All metal contact closures.
- Available in self contained and remote mount.
- Ultra miniature to standard size keypads.
- Vertical or horizontal styles for limited space.

600L Proven Workhorse

- Backlighted silicone rubber alphanumeric keypad.
- Reliable all metal keyboard switches.
- Continuous or tone burst DTMF operation.
- Universal impedance matching.
- Audible sidetone for tone verification.
- High quality 7′ coiled cord.



All CES microphones are available off the shelf "Radio Ready" for most popular radio models, and are stocked for same day shipment.

CES

Communications Electronics Specialties, Inc.

931-218 So. Semoran Blvd.
Winter Park, FL 32792
Telephone: 407-679-9440
Toll Free: 800-327-9956
Fax: 407-679-8110

Make The RIGHT Connection

Circle (7) on Fast Fact Card

Letters to the editor

The petition resulted from nearly two years of effort by the APCP council to develop a workable scheme to help alleviate the interference problems on currently licensed PCP channels, as well as to ensure that new licensees will be able to operate in an efficient, interference-free environment in the future.

I hope the APCP petition will be acted on expeditiously by the commission and that the new rules will be adopted quickly. The last place any PCP operator wants to be is in litigation before either the FCC or the courts.

Kevin O'Brien
O'Brien Communications
Annandale, VA

Fast Fact Card comment:

The toughest problems on the job are convincing clients to upgrade to newer technology, especially the way the recession has hit us in the Northeast, and competing with the larger representatives and repair shops that control most of the antenna sites in the area.

Christopher Murdock
The Radio Doktors
Skowhegan, ME

Passive repeaters:

In reference to the letter from Dave Barquist about passive repeaters published in October, count me as one of the "few technical types" he mentions.

I am frustrated, not because I cannot hook up a VSWR bridge, but because of the myriad mobile antenna companies in our industry that take advantage of the naive consumer and provide all types of gimmickry in their quest for mobile antenna sales. We saw some of this during the CB craze a decade ago.

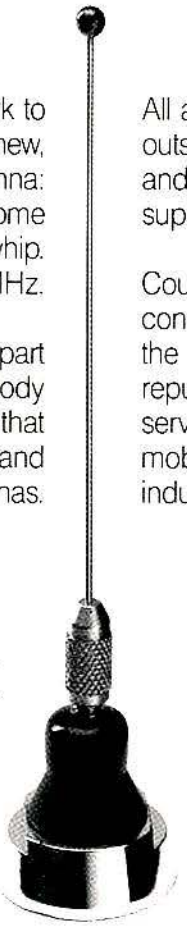
The mobile passive repeater marketed by many of the manufacturers flies in the face of antenna theory. Passive repeaters work in very special, limited applications, but not in most vehicles with glass windows. The theoretical loss from outside reception to inside reception of these passive repeaters far exceeds the attenuation of the vehicle glass. Further, most of these mobile passive repeaters are cross-polarized, thereby increasing the loss.

I am not familiar with Mr. Barquist's company, Electronic Products of Hartland, WI, but I do know Antenna Specialists and Dale Horn, its vice president of engineering. Mr. Horn is one of the premiere antenna engineers in our industry. He is a man of the highest integrity. Neither he nor his company would make false claims to justify anything. Antenna Specialists is a high-quality company that does not need to market gimmicks to be successful.

It would be interesting to know the letter-writer's educational and professional background. His letter was an insult to the legitimate antenna industry.

Raymond C. Trott, P.E.
President
Raymond C. Trott Consulting Engineers
Irving, TX

Now, a two-way line you can count on.



Count on Mobile Mark to come up with this new, economical two-way antenna: shown with a black-chrome base and a ¼ wave whip. Available for 140-950 MHz.

It's just one dependable part of our new roof and body mount antenna line that includes UHF, VHF and Low band antennas.

All are engineered for outstanding performance, and backed by solid sales support and warranty.

Count on Mobile Mark for continuing service long after the sale, too. Our 43-year reputation for responsive service is unequalled in the mobile communications industry. Call today.

1 **Quick Disconnect Mechanism** lets the whip come off easily.

2 **Spring Loaded Center Contactor** means quality reception that lasts.

3 **Neoprene O-Ring Seal** effectively keeps moisture out of the connection.

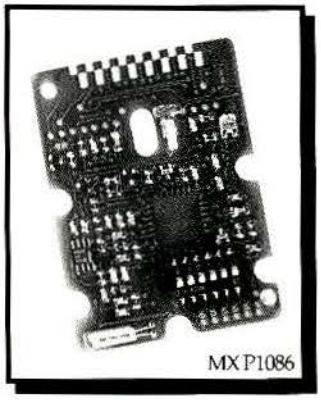
MOBILE MARK
COMMUNICATIONS ANTENNAS

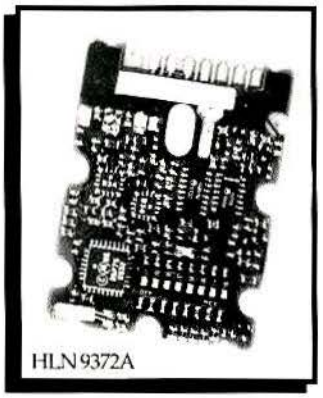
3900-B River Road, Schiller Park, IL 60176 800-648-2800 or 708-671-6690

Circle (8) on Fast Fact Card

GET REAL

Privacy with *Pvt* SQUELCH™





Pvt SQUELCH™	vs.	PL*
Motorola Radius P50 compatibility		Yes
38 Programmable CTCSS tones		Yes (34)
On-chip inversion scrambler		NO
Privacy protected by law		NO
PVT / CLR selection		NO

Real privacy is now available for the Radius P50™ — Introducing the MX P1086 *Pvt* SQUELCH™ alternative to PL.

Both fit the Radius P50 option well, both encode/decode CTCSS tones, and both cost about the same. Unlike the PL option, the MX P1086 uses CTCSS controlled scrambling to render interception of your radio messages unlawful.

To get *real* privacy for your Radius P50, contact your dealer or Call Toll Free:

1-800-638-5577

MX·COM, INC.

4800 Bethania Station Road, Winston-Salem, NC 27105-1201
In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054
In Canada Call: Omni
East/514-648-8432 • Central/416-841-6740 • West/403-291-9639

* PL, Motorola and Radius P50 are trademarks of Motorola, Inc.

Circle (9) on Fast Fact Card

Maintain station batteries with computer assistance

Computerized evaluation improves maintenance of stationary batteries in mobile radio, microwave and other facilities to ensure emergency power availability and to reduce maintenance costs.

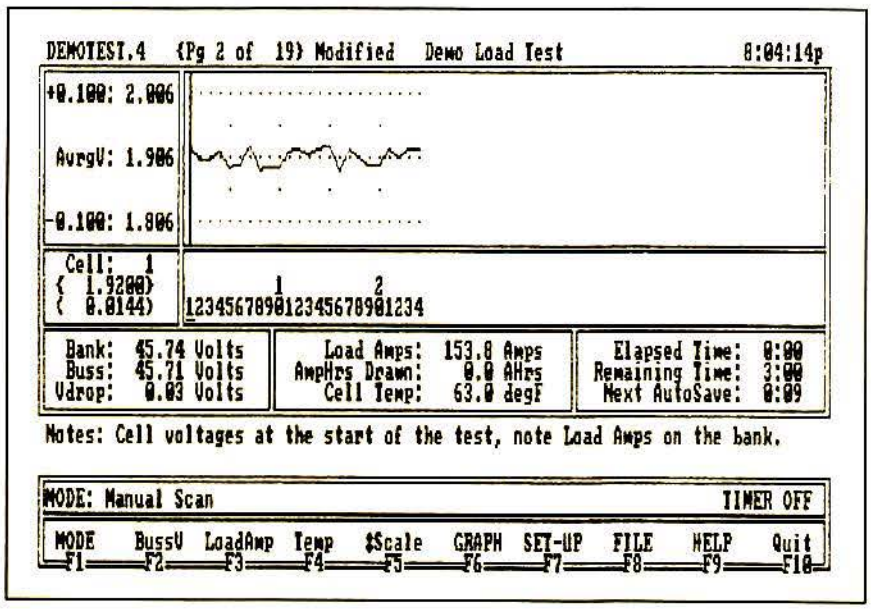


Figure 1. A video display from the start of an actual load test.

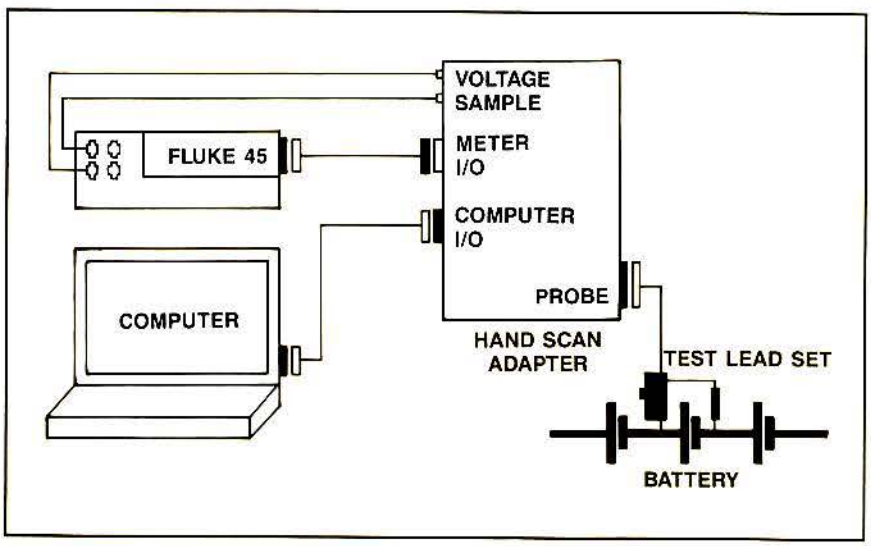


Figure 2. The system has three data-collection modes: manual, hand and auto scanning. This diagram shows the hand scanner connections.

By Lynn H. Hansen

Electric utilities cannot guarantee 100% service reliability, so nearly every remote radio communications site uses a stationary battery system to sustain operations during power outages.

If you do not maintain the stationary batteries properly, they may not deliver rated capacity or may not perform at all when called upon for emergency power.

Each element in the system needs care. For example, one cell with diminished capacity can reduce the entire system's performance. One buss bar with a high-resistance connection can render the system useless.

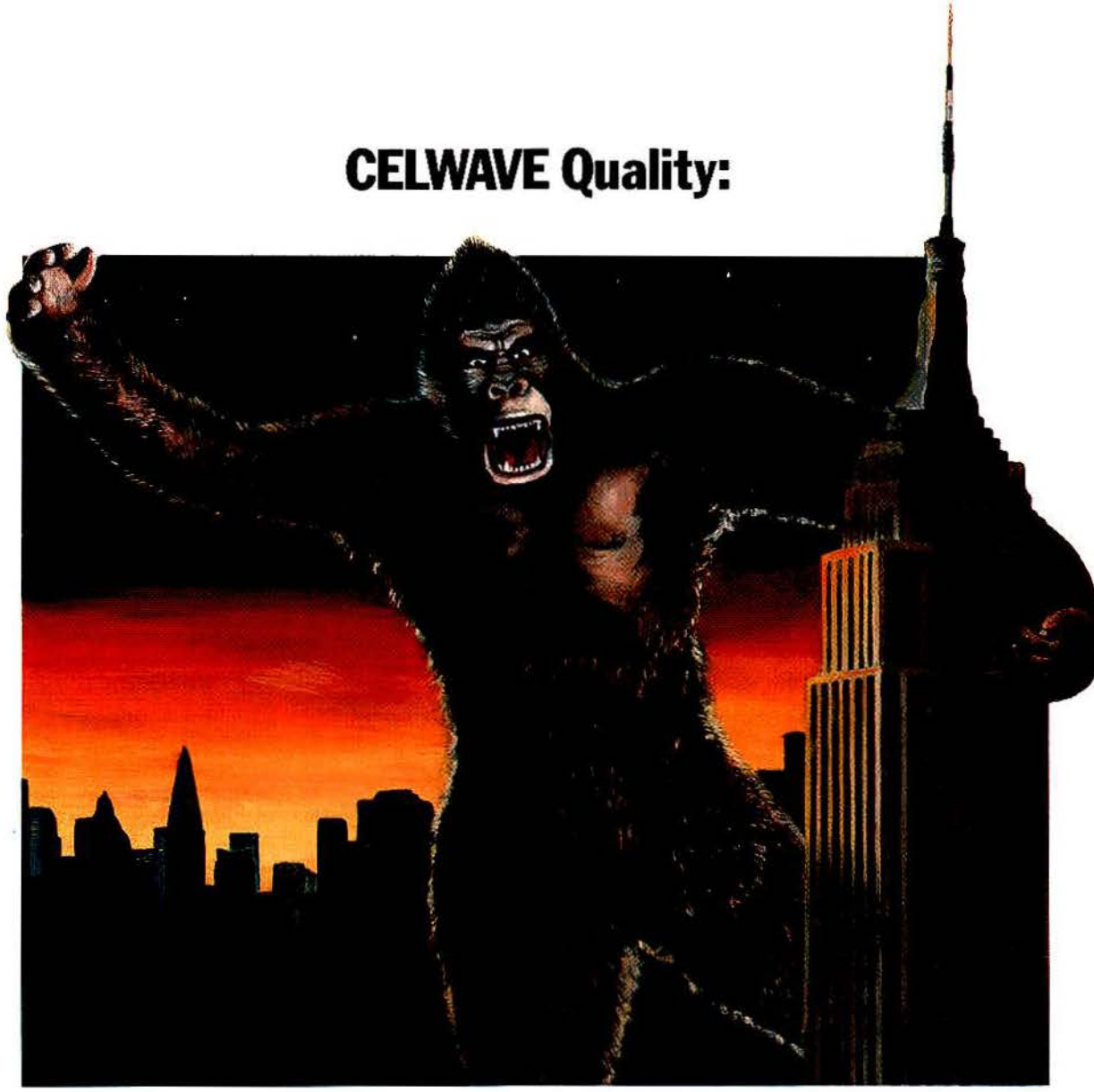
One approach to system maintenance requires the technician to take multiple measurements and fill out endless forms. Problems may go undetected or unresolved because the forms are filed away at headquarters and because the technician usually does not have the responsibility for evaluating the data.

The same data, processed by a computer, can alert the technician or manager to problems in time to fix them before an outage occurs. For example, data from a quarterly test or a load test can be entered into a spreadsheet program. The program draws graphs to detail individual cell voltages and buss bar resistances.

A better method is to use an integrated battery evaluation system designed for battery maintenance and testing. It automates battery maintenance

Hansen is president of Scan-Tech Enterprises, Salt Lake City, the company that manufactures the battery maintenance program described in this article.

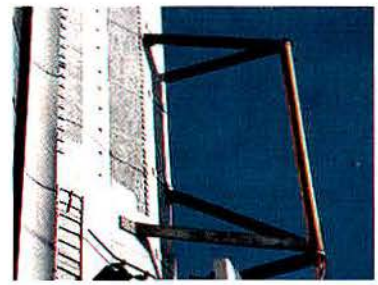
CELWAVE Quality:



There hasn't been anything this big and ugly up here since King Kong.

Goodbye, nulls. Get lost, voids. Good riddance interference. The brute is on the loose and it's ours. All ours. It's the proven, Bogner antenna design that delivers broadcast quality in cellular, mobile and paging operations.

Celwave has renamed it: The Penetrator, and this beast is a thing of beauty. A whole line of patented, UHF and 800/900 MHz land mobile base station antennas that perform like a dream. Their array of side-fed



dipoles maximize pattern and impedance band width, providing high gain, heavy null fill and variable beam tilt.

CELWAVE

The Penetrator gives Celwave a very big advantage in customizing solutions to your antenna site problems. At the very top, the very bottom and everywhere in between.

Call 1-800-321-4700 now for assistance in selecting the proper beam tilt and pattern for your application.

CELWAVE, Route 79, Marlboro, New Jersey 07746.
Tel: (201) 462-1880.
Telex: 4944313 CEL NJ

RFS

© Celwave 1989

Circle (10) on Fast Fact Card
Visit us at IMCE, Booth #820.

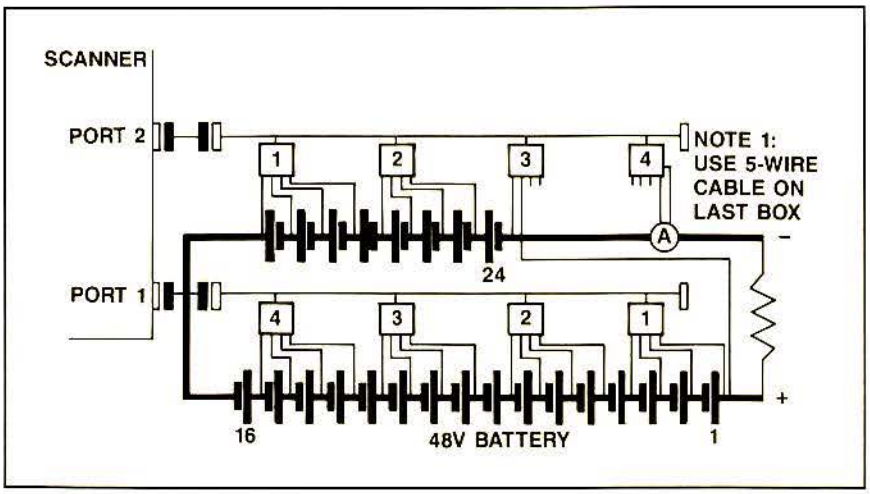


Figure 3. One auto scanner, connected to a 48V battery system, monitors as many as 64 points and collects data automatically during battery load testing.

data-collection tasks and presents the data as they are collected in an easily interpreted form for on-site evaluation.

One such system, the Battery Scanner System, uses an IBM-compatible computer and collects, logs and displays all the measurements and tolerance limits involved with battery maintenance and load testing. Figure 1 on page 10 represents a video display from the start of an actual load test.

The system has three data-collection modes.

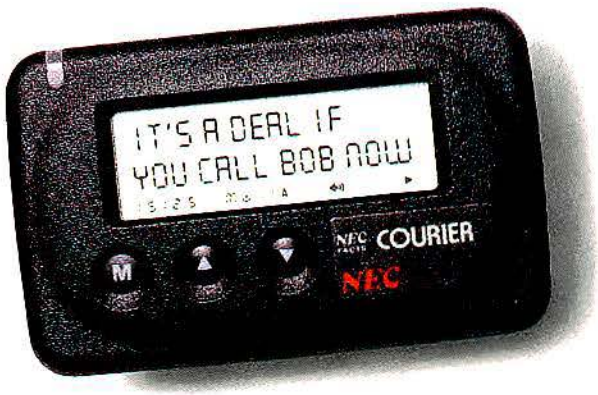
► *Manual scanning*—You can enter all data via the keyboard. This manual scanning method allows the use of existing test equipment.

► *Hand scanning*—You can use a Fluke 45 digital voltmeter (DVM) connected to the computer's serial port via an adapter for hand scanning. Measure cell voltages with the hand scanner's test probe and, as you make each connection, press the probe's button. The process is as simple as "point and shoot." The program logs the measurement automatically, updates various attributes and redraws the graph using the new data. Figure 2 on page 10 shows the hand scanner connections.

► *Auto scanning*—Using the Fluke 45 DVM with one or more auto scanners, the system collects data automatically, as normally is done during battery load testing. Each auto scanner monitors as many as 64 points. As many as four auto scanners can be used, allowing as many as 256 points to be monitored. Figure 3 at the left shows the auto scanner connected to a 48V battery system.



Circle (11) on Fast Fact Card

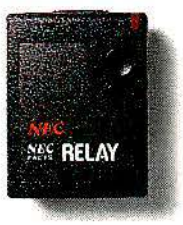


Some messages can't wait until you get back to the office. You can imagine the scenario. You're out on the road and your pager goes off. You check the screen and don't recognize the telephone number. Figuring there's no rush, you decide to wait until you get back to the office to find out who called.

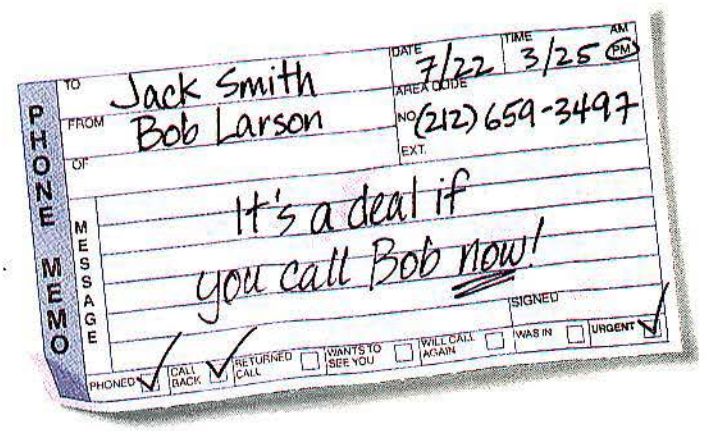
Sooner.

But with NEC's Facts Courier™ pager, you can still take the message when you can't take the call. It spells out messages of up to 32 characters on its easy-to-read, illuminated screen. Its 6500-character memory base provides you with push-button access to as many as 40 messages, addresses, memos or reminders.

Another NEC pager worth checking out is the Facts Relay.™ It can store up to 16 messages of up to 20 characters each (maximum storage capacity of 200 characters). And its 12-character illuminated display is easy-to-read—even in the dark.



No matter where your business takes you, NEC's new Facts family of pagers will keep your messages coming. All are engineered with the quality and reliability you've come to expect from NEC, a world leader in computers and communications. Make sure you get armed with the Facts from NEC soon! For more information, please call 1-800-225-5664.



Or later.

© 1991 NEC America, Inc.

NEC

Circle (12) on Fast Fact Card

How to avoid a

Introducing the C-Mark Series of GE-Star®/Star

In a crisis, knowing the exact meaning of an ANI message can mean the difference between life and death.

That's why Cimarron Technologies designed the advanced, new C-Mark series of ANI decoders.

They're the only decoders that identify and display unique codes for all these messages:

- "Emergency"
- "Man-Down"
- "Stuck-Mic"
- "Request to Talk"
- "ANI-ID"
- Or choose "Status" or "Canned" messages.

The C-Mark Series offers a lot of other important advantages, too:

- Built-in data mute circuit.
- Built-in diagnostics.
- RFI-protected housings.
- LED display with adjustable brightness.
- Display readable from 30 feet.
- Five-year clock battery backup.
- Serial, printer/computer output.
- Front-panel format programming.
- "Scroll" and "Hold" display modes with review of stored information.
- GE-Star/Star compatible.



The C-Mark II single-window ANI decoder-display. List price $995.

n identity crisis.

ANI decoders from Cimarron Technologies.



Battery operated hand-held programmer

A COMPLETE SYSTEM WITH COMPLETE SOLUTIONS.

Cimarron Technologies offers you a complete, versatile ANI solution for your mobile radio system, including:

- CEU-1 sub-miniature encoder.
- C-Mark I computer interface.
- C-Mark II single-window.
- C-Mark III multi-window.
- Battery-operated, hand-held programmer.
- No-hassle three-year warranty on materials and workmanship.

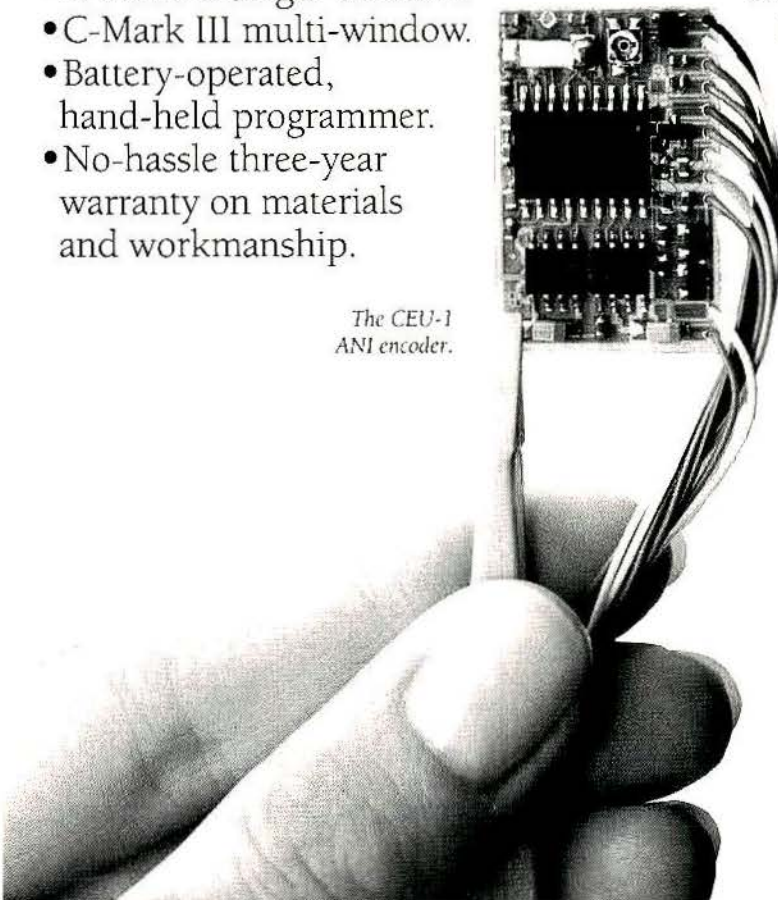
IT'S MORE THAN JUST ANI. IT'S CIMARRON.

Find out more about the versatile, economical new technology that gives you all the advantages of ANI and a whole lot more. Contact your mobile radio dealer or Jack Batchie, Sales Manager, Cimarron Technologies, 934 South Andreasen Drive, Suite G, Escondido, CA 92029-1919, 1-800-487-7184 in USA and California. Or (619) 738-3280.



The C-mark III multi-window ANI decoder-display.

CIMARRON TECHNOLOGIES



The CEU-1 ANI encoder.

GE-Star is a registered trademark of General Electric Corporation.

Circle (13) on Fast Fact Card

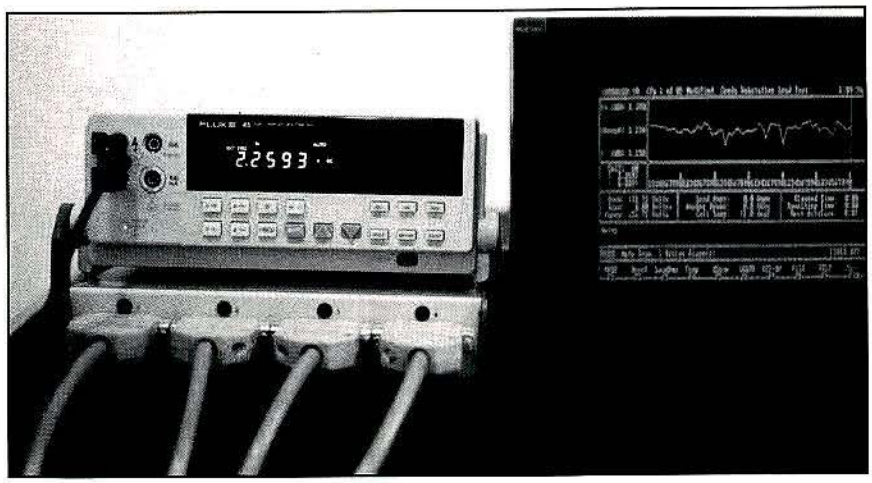


Photo 1. The computer, auto scanner and DVM in operation. Scanning hardware connects to the computer via a single serial port.

Portability is one of the system's main advantages. Scanning hardware connects to the computer via a single serial port. No internal expansion cards are required, so no expansion slots are needed.

The system is optimized for use with laptop and notebook-type computers. Photo 1 above shows the computer, auto scanner and DVM in operation. The four cables attached to the auto scanner connect to the sample cables shown in Figure 3.

The system contains a test timer; online help; a scratch pad for notes; a manufacturers' database that can set up test limits; a report generator; and an alarm subsystem that alerts the operator when measurements exceed tolerances. These functions are accessed through the computer program menu. Test data are stored on disk memory to document the results.

When properly performed, maintenance procedures reveal battery condition.

For lead-acid cells, a specific gravity measurement indicates state of charge. Because many variables such as temperature, electrolyte level and electrolyte stratification affect specific gravity measurements, the measurements may be of little value.

State-of-charge can be ascertained by switching the charger to EQUALIZE and noting how long it takes the charging current to return to near-normal float current. If the battery is fully charged, the transition should take place within seconds.

Perhaps the best way to keep batteries fully charged is to float them at the voltage the manufacturer recommends. Many batteries are damaged by an improper float voltage, so you should check the float voltage and cell electrolyte levels monthly.

Every three months, check:

- ► bank float voltage and electrolyte levels.
- ► individual cell float voltages.
- ► station load current.
- ► ripple voltage (wideband ac noise).
- ► individual cell voltages while the bank delivers load current. Shut off the charger and wait for the bank voltage to stabilize before measuring cell voltages.
- ► buss bar resistances. These resistances can be calculated by measuring the voltage drops from battery post to battery post *while the battery is delivering load current* and by dividing this voltage by the current flowing through the connection at the time.

This procedure not only collects valuable data for tracking battery performance, it exercises the battery and charger system. Many technicians do not like to remove the charging voltage from a battery. But if you do not remove the charging voltage, how will you know that your system can recover from a power outage? If it cannot recover from a power outage, would you rather find out when you are there to conduct tests or when the power fails at 3 a.m.?

Many technicians do not like to remove the charging voltage from a battery.

A cell loses its ability to deliver terminal voltage under load when its internal impedance rises. Internal impedance can be measured with an impedance tester. Another way to detect an increase in internal impedance is to measure and plot bank cell voltages carefully under load. A cell voltage significantly lower than the average indicates that the cell's impedance has risen. A difference of 0.03V below the average can be significant.

Load testing

Load testing is the only way the battery industry recognizes for verifying battery capacity: Disconnect the battery charger, connect a suitable load across the battery and discharge it.

What is complex about the procedure is the selection of a suitable load. Manufacturers publish discharge time vs. load specifications. The specifications must be corrected for bank temperature

Quarterly measurements

Every three months, check the following:

- ☐ **Bank float voltage and electrolyte levels.**
- ☐ **Individual cell voltages.**
- ☐ **Station load current.**
- ☐ **Ripple voltage.**
- ☐ **Individual cell voltages under load.**
- ☐ **Bank voltage under load.**
- ☐ **Buss bar resistances.**

The New STABILOCK® 4015 Radio Test Set Tests Great–Less Weight

Under $13K/3 Year Warranty

Finally, a two-way radio tester that fits under a helicopter seat, weighs less than 20 lbs., provides all the capabilities you've dreamed of in one unit, and doesn't cost an arm and a leg.

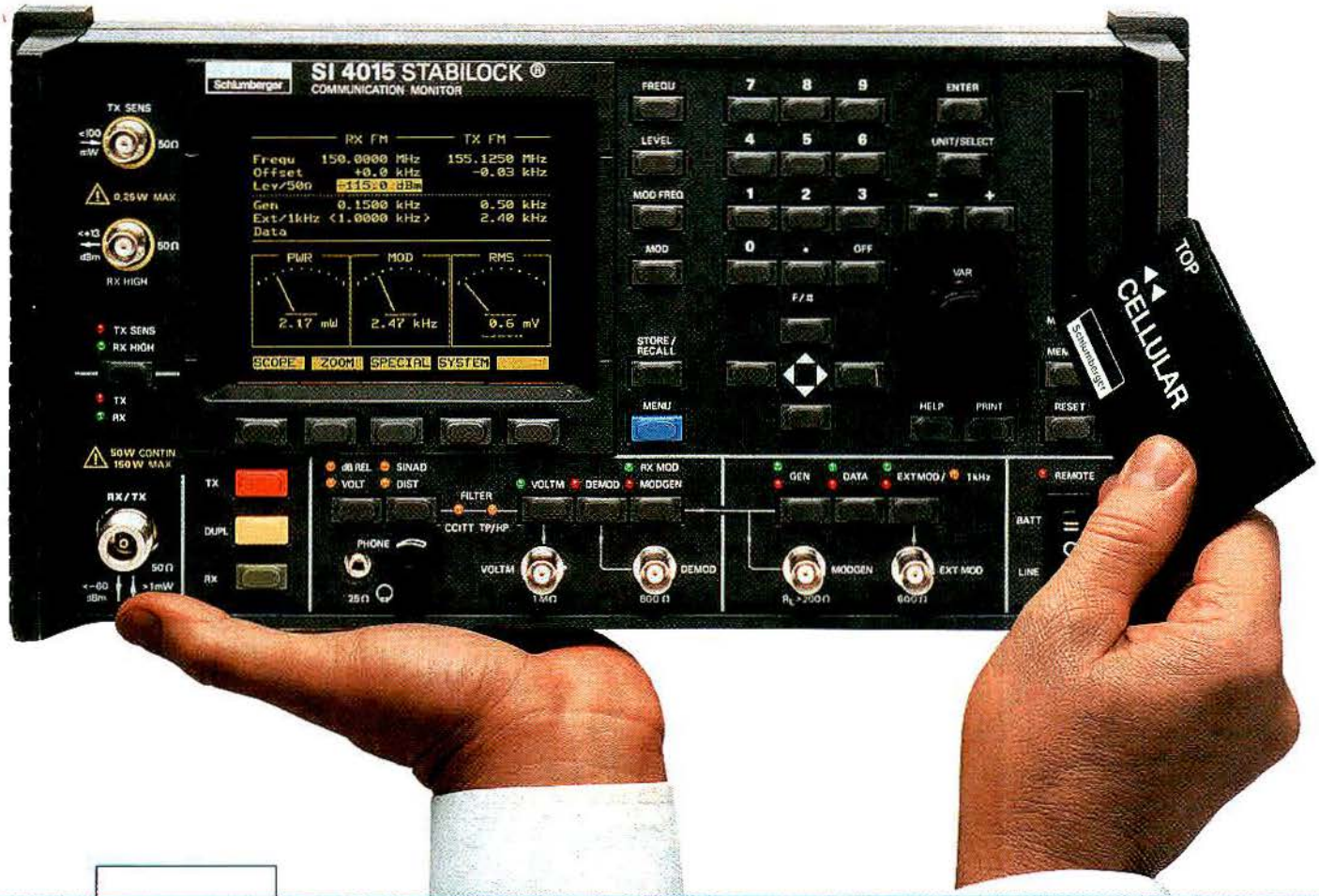
The STABILOCK 4015 packs a lot of features in a compact design:

- ☐ spectrum analyzer with audio
- ☐ electroluminescent display for easy viewing night or day
- ☐ licensed CLEAR CHANNEL LTR® testing capability
- ☐ memory cards to load and run tests automatically, including all cellular formats
- ☐ digital storage oscilloscope
- ☐ internal battery

Lighten your two-way test load today–call for more information on the STABILOCK 4015: **1-800-225-5765 (in MA: 508-671-9700).**

CLEAR CHANNEL LTR is a registered trademark of the EF Johnson Company. STABILOCK 4015 is a registered trademark of Schlumberger Technologies.

Quality Test Solutions
Schlumberger Technologies



Schlumberger Technologies

Schlumberger Instruments
P.O. Box 7004
829 Middlesex Turnpike
Billerica, MA 01821, USA
Phone-508-671-9700
Fax-508-671-9704
1-800-225-5765 (outside MA)

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone-44 252 544433
Fax-44 252 543854
Telex-858245

Schlumberger Instruments
50 Avenue Jean Jaurès
BP 620-06
F-92542 Montrouge Cedex, France
Phone-33 1 47 466700
Fax-33 1 47 466727
Telex-631468 ENERINS

Schlumberger Technologies GmbH
Ingolstädter Str. 67a
D-8000 München 46
West Germany
Phone-49 89 31889-0
Fax-49 89 31889-160
Telex-5215015 SMG D.

Circle (15) on Fast Fact Card

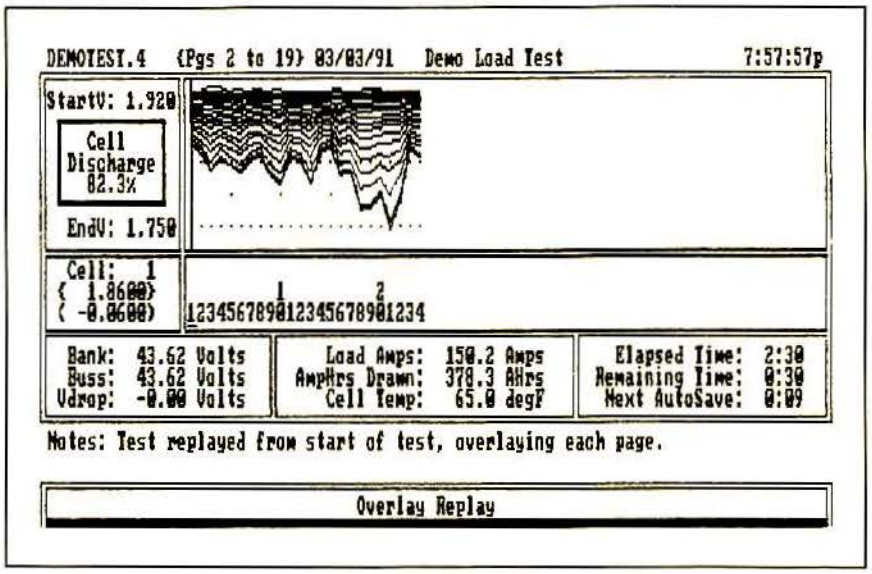


Figure 4. The system replays a test, forming a characteristic curve for each cell relative to other cells. Notice how trends are readily apparent. Weak cells are found easily, which allows intelligent decisions to be made regarding maintenance and replacement schedules.

when the test is made. The computerized battery evaluation system's database files list various manufacturers' recommended test data, and its software corrects for temperature.

Safety is the No. 1 concern during a battery load test. During a test, the battery usually delivers current in excess of its normal load. If anything goes wrong, chances are it will happen during a load test, so all cell voltages should be monitored continuously during the test.

If a cell completely discharges during a test, it must be strapped out or removed from the string. If its polarization is allowed to reverse, irreparable cell damage can occur. When its polarization reverses, the cell begins dissipating power as heat because it begins acting as a load. Continuous application of power to the cell may cause it to explode.

The computerized battery evaluation system can plot cell data against two references: average bank cell voltage or each cell's voltage at the start of the test. These plots allow the operator an actual view of each cell's condition. The system can plot bank voltage as it decays throughout the test, giving a clear indication of remaining capacity.

Thoroughly documenting a load test without computer assistance is challenging. For example, measurements taken every 20 minutes on a 24-cell battery during an eight-hour test include 480 readings. These readings are tedious to collect, and they are difficult to interpret as useful trends.

The computerized battery evaluation system solves the problem by replaying a test without erasing the data from previous test pages. Thus, the system can form a characteristic curve for each cell relative to other cells. An example of such a curve is shown in Figure 4 at the left.

Notice how trends are readily apparent. Weak cells are found easily, which allows intelligent decisions to be made regarding maintenance and replacement schedules.

The test shown in Figure 4 shows five cells approaching the end-of-test voltage of 1.75V. These five cells were located near the station's emergency generator. The graph reveals how thermal cycling can damage stationary batteries.

Compare Figure 4 with Figure 1. Initial cell voltages under load in Figure 1 *did not* indicate *higher* than average internal cell impedance (which would have shown up as *lower* than average terminal voltage *under load*), even though five cells were extremely close to the manufacturer's replacement requirement of 80% capacity.

Battery maintenance

Computerized evaluation improves preventive maintenance of stationary batteries in mobile radio, microwave and supervisory control and data acquisition station facilities to ensure emergency power availability and to reduce maintenance costs.

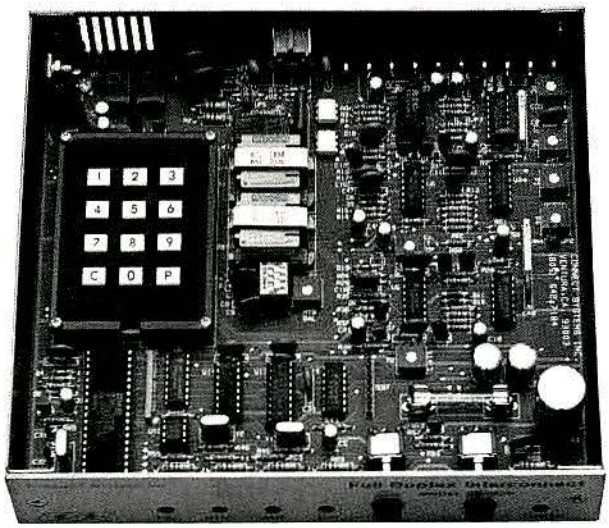


Circle (14) on Fast Fact Card

What to look for in a Patch

For ten years CSI has been producing the best value going in interconnect. When you compare price and features, you will find that brands A-Z simply do not measure up. Here's ten reasons your next interconnect should come from CSI . . .





FULL DUPLEX MODEL CS-800
$299 Dealer Net

CALL OR WRITE ABOUT:

- Simplex Interconnects
- Control Station Interconnects
- Duplex Interconnects
- Interconnect/Repeater Maker
- Interconnect/Paging
- Interconnect/Remote Base
- Radio/Telephone Remote
- Shared Repeater Tone Panel
- Interconnect/Tone Panel
- Rural Telephones

1. FCC/DOC REGISTERED

It is not legal to sell telephone products in the U.S.A./Canada that are not FCC part 15 and 68 or DOC CS-03 registered. **BEWARE:** Many interconnects offered for sale **are not approved.**

2. HIGH TECH FEATURES

CSI interconnects are loaded with high tech features that are simply not available in competing products. For example: Memory Speed-Dialer, Redial, Hook-Flash, Multi-Mode Capability, and more, plus . . .

3. PROGRAMMING KEYBOARD

The competition takes the cheap route and makes you use the DTMF pad on your radio to enter programming data. All CSI interconnects feature a built-in programming keyboard plus . . .

4. PROGRAMMING DISPLAY

Imagine operating a computer without a monitor to look at. That's what it's like when you program a competitor's interconnect. You can't see what you are doing. Incorrect entries could cause hours of unnecessary trouble-shooting. All CSI interconnects feature a two-digit display (located between the keyboard and the rear panel) that lets you see your data entries plus review any previously entered data.

5. QUALITY CONSTRUCTION

Our printed circuit boards are top-quality glass with solder mask over bare copper. A silkscreen legend clearly identifies the locations of all components. Top quality components are then machine inserted into the board followed by wave soldering and immersion cleaning. You will not find a trace of solder flux on the finished product!

6. LIGHTNING PROTECTED

All CSI models incorporate MOV protection, and most models have phone line fusing as well. We've experienced excellent survivability.

7. QUALITY PACKAGING

All models are packaged in heavy gauge steel and aluminum chassis and cover components. All metal parts are plated and finish painted as appropriate. The front and rear panels are silkscreened with permanent catalytic ink legends.

8. POWERFUL OPTIONS

2-Tone, 5/6 Tone and CTCSS options allow selective calling/paging. There's even a dial click detector to allow selective calling/paging from dial pulse telephones. Other options include Electronic Voice Delay, CTCSS board and Aux. Relay. (DTMF signalling is standard).

9. FREE CUSTOMER SUPPORT

Our engineers and technicians are at your disposal to help with your system level and installation questions when required. Simply use our toll free 1-800-number.

10. ONE YEAR WARRANTY

We do not think it's possible to have a lower failure rate than we experience. However in the unlikely event your unit should fail, we stand behind it one full year free parts & labor.

Connect Systems Inc.
2064 Eastman Ave., #113
Ventura, CA 93003

Toll Free (800) 545-1349
Phone (805) 642-7184
FAX (805) 642-7271

Circle (16) on Fast Fact Card

Digitally coded squelch: Radio/board compatibility

Part 3—This installment completes the discussion of noise and sampling, explains how your radio influences DCS performance and tells you how to evaluate software vendors that claim to have DCS expertise.

By Mark Nadir

A savvy technician's talents are essential for determining which digitally coded squelch (DCS) encoder-decoder is best suited for a particular radio transceiver. Certain problems that may affect DCS encoder-decoder operation are unrelated to the encoder-decoder. Instead, they are inherent in the radio.

Advice from a sharp technician makes all the difference in evaluating DCS products fairly. A DCS product purchase should be made only after a thorough technical evaluation.

Original equipment manufacturer (OEM) radio vendors that do not offer a DCS option for their transceivers can overcome this limitation. It may be possible to incorporate a DCS option into a microprocessor-controlled transceiver's firmware. A word of caution: Watch out for the pitfalls, and make sure the job gets done right the first time.

First, some concluding remarks about sampling and correlation, to complete the basic information about DCS systems.

In Part 2, correlation is described as one method for decoding DCS signals, with limitations. An incoming bit pattern is "correlated" against a known reference codeword. If the two sufficiently agree, the DCS decoder unsquelches the radio.

To overcome sampling anomalies and to get a better look at a DCS signal in noise, the decoder samples data at five times the baud rate, resulting in a sampleword length of 115 bits. Permitting no correlation errors—i.e., perfect correlation—is unrealistically stringent. Conversely, permitting too many—e.g., 58, or half a sampleword—results in perfect *noise correlation* and allows a decoder to decode noise frequently as though it were a valid DCS codeword.

The subject of *noise falsing* is complex. But an intuitive approach helps to understand it.

Assuming random noise is sampled to look for a 23-bit DCS codeword, then every 2^{23} bits, the exact 23-bit pattern should appear randomly. (A 23-bit word has 2^{23} or 8,388,608 binary combinations.)

Thus, this hypothetical DCS decoder randomly noise-falses about once every 17 hours. To maintain this noise-falsing rate, the 23-bit decoder requires perfect correlation.

If the sampling rate is doubled, the correlation length grows to 46 bits, the number of possible combinations grows exponentially, and the noise-falsing rate substantially reduces.

If this improvement in noise falsing is traded away by permitting more correlation errors, the decoder sensitivity improves. Meanwhile, the noise-falsing rate can be about the same for the 23-bit and 46-bit correlators.

It is plausible to say the decoder's sensitivity, sampling rate and noise-falsing rate are related, although their relationship is not obvious. Figure 1 at the right is a computer-drawn graph that shows the relationship among these variables for acceptable noise-falsing rates. It shows multiple curves. Each curve corresponds to a different sampling rate and error threshold.

For example, the curve labeled [46,40] is for a correlation length of 46 bits (two samples per bit) with an error threshold of 40 bits correctly decoded.

These curves are plotted against the bit error rate (BER) of the incoming data (Y axis) vs. the probability of *not* detecting the DCS codeword (X axis) with that BER. In both cases, a zero-valued result represents the optimum value. In other words, zero BER means no bit errors, and a zero probability of

Nadir is president of Globestar Technology, Ft. Lauderdale, FL; telephone 305-763-1569. The company specializes in the design and implementation of digital radio systems for clients worldwide.

Author's note:

Judging by readers' telephone calls, several people are misinterpreting these digitally coded squelch (DCS) articles as "How To Design Your Own DCS Encoder-Decoder." With multiple DCS vendors building product, it is important for technicians to know how digital squelch works—the purpose of these articles.

Therefore, the subject matter has been limited to topics that contribute directly to this understanding. Topics that are superfluous to *understanding* how DCS works, but not necessarily superfluous to *designing* DCS circuits, have been omitted. As a result, these articles are incomplete as a "DCS Designer's Guide." For readers who are inclined to poke at a land mine with a short stick, please consider where you tread.

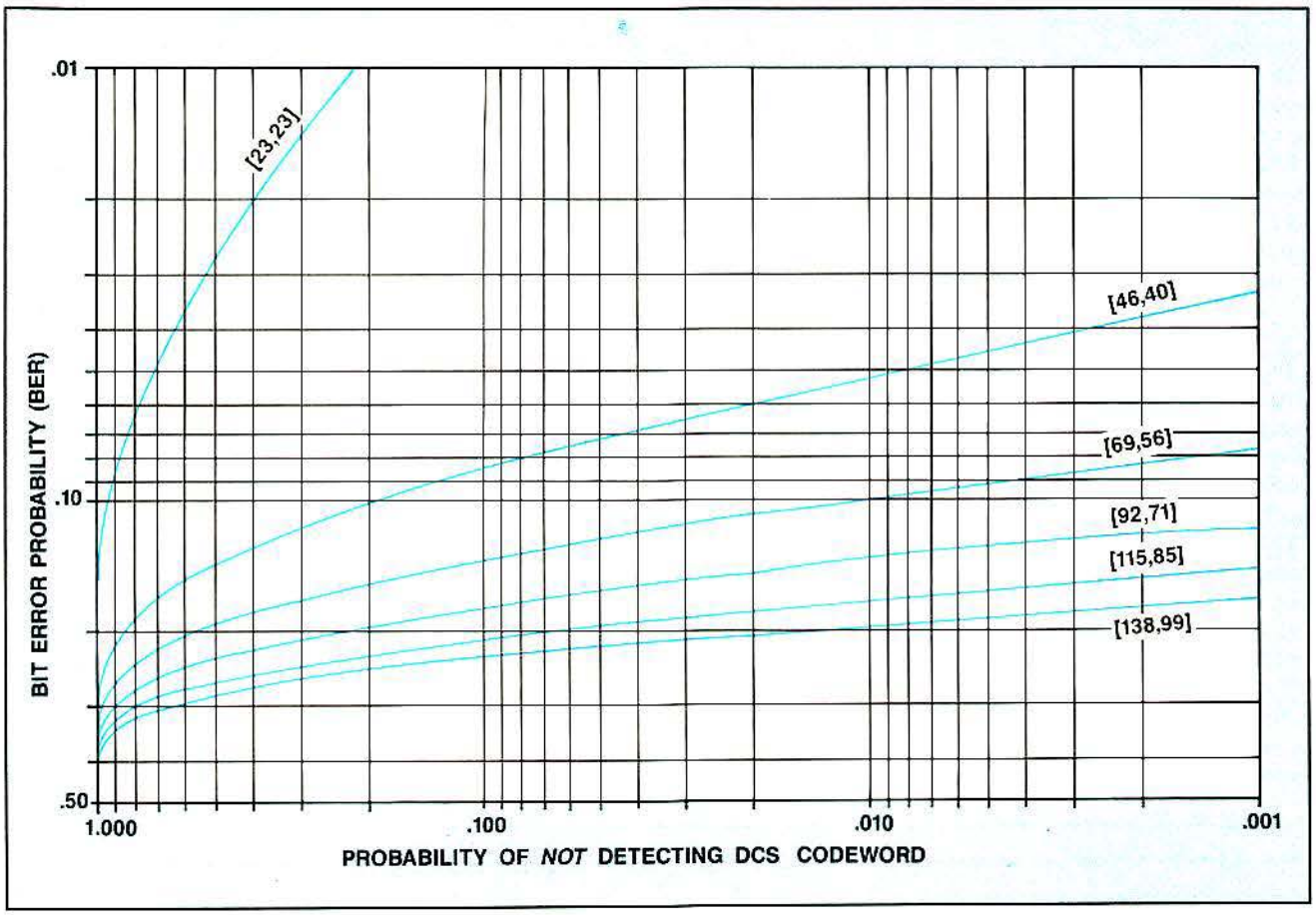


Figure 1. This computer-drawn graph shows the relationship between the bit-error rate (BER) and the probability of missing the DCS codeword for acceptable noise-falsing rates. The label [x,y] on each curve represents the sampling rate, a multiple of 23 bits, and the number of bits required for each correlation.

not detecting the codeword is ideal, as well.

Figure 1 makes it apparent that DCS decoder performance can be improved by oversampling the incoming data. In fact, sampling at just twice the DCS baud rate offers impressive improvements. But other practical considerations influence decoder design, and compromises must be made.

Fortunately, despite its theoretical complexity, noise falsing is easy to measure experimentally. When you evaluate a DCS decoder for use in a given radio transceiver, measuring the noise-falsing rate can determine quickly whether the combination is compatible.

Not all correlators are created equal. For decoders that use correlation, the digital algorithm can affect the decoder attack time greatly, as well as the decoder's noise performance. Ultimately, how well a decoder functions is best determined experimentally.

A DCS encoder-decoder should be evaluated in the target radio transceiver before the entire fleet of units is equipped or outfitted. Reputable OEM radio vendors that offer a DCS option, forced to warranty their products, usually have done at least some testing.

It is cheap insurance, though, for the user's technician to measure how well the OEM DCS encoder-decoder works. These measurement results later can be compared with the performance of an add-in board purchased from a DCS vendor.

With the large number of available mobile and hand-held transceivers, it is nearly impossible for the board-level DCS vendor to evaluate its product in every one. Many buyers are attracted to products by pricing, and the DCS vendor can test product in only a limited number of radios without raising the price. Often, the DCS vendor supplies a list of radios tested with their product and instructions for modifying the radio for DCS operation.

To select a DCS vendor, evaluate several board-level products, and use the one that works the best. Because designs vary, one decoder may work better than another in any given application.

Most DCS vendors want to hear constructive and useful feedback from users. They may appreciate having details about your successful modification of a radio transceiver for DCS operation.

Your radio

Often, successful DCS operation depends as much on the radio as it does on the encoder-decoder. Most radios must be modified to use DCS, especially if the OEM radio vendor does not offer a DCS option. When such an option is available, the radio manual normally shows what, if any, modifications are necessary. The radio manual and the DCS product vendor's manual form the

starting point for the installation procedure.

Be skeptical immediately of any DCS vendor that claims its product works in every radio. Considering the variety of OEM radios available and the different design philosophies of the DCS vendors, most radios require some modification before they are DCS-capable. Some of the newer radios may indeed be plug-in compatible, but check for yourself.

In general, modifications usually include changing audio stage coupling capacitors to extend the low-frequency response for proper DCS operation. DCS requires an audio response down to 2Hz or less. (See Part 1.)

Quite often, some parts are added to the radio to keep part of the receiver biased while the transmitter is operating. The bias limits dc transients reaching the DCS decoder when the push-to-talk (PTT) switch is released. Because of the audio stages' long time constants, DCS decoders are prone to block until this transient settles out. Without the proper fixes, the decoder turnover time (the minimum time for decoding a valid DCS signal after the PTT is released) often is excessive (two to six seconds).

Scrutinize your radio fleet before deciding to change from continuous-tone coded squelch system (CTCSS) to DCS. Some older phase-modulated transmitters may require so much modification to get the necessary low-frequency response that it is impractical to alter them. Conversely, the construction of certain modular transceivers may not permit the technician access to the internal components, preventing the necessary modification. Do not forget about your base station or repeater. It must be DCS-capable, too.

It is a good practice to check the radio transmitter's audio response as measured from the microphone input, especially for radios only capable of carrier squelch operation. Some radios have no high-pass filtering on the mic audio. They permit low-frequency signals into the subaudible channel reserved for DCS signaling.

In this case, operators with loud, bass voices may block the DCS decoder in the receiving radio, causing its squelch to open and close as they speak. Most CTCSS-capable radios have some high-pass filtering in the transmit audio response. When you make this test, remember that some mics have a poor bass response, and some active mics have a built-in high-pass filter. If necessary, it may be possible to add a high-pass filter or to alter some components to attenuate the mic's subaudible response.

Software DCS vendors

OEM vendors that do not yet have a DCS option available for their products may be able to incorporate one into their present radio designs economically. If the transceiver uses a microprocessor to manage the radio operation, the software processes for DCS operation can be added to the radio's firmware. This task normally is accomplished by a DCS software vendor. It requires excellent analytical hardware skills and well-

Don't Let DISTANCE Come Between You and Your LTR Trunked Radio System



Distribute Control of Your Trunked Radio System Precisely Where You Need It.

Zetron's Trunked Radio Remote Control System overcomes the problem of controlling your E.F. Johnson 8600-series control stations from multiple locations within a building or campus environment. With the Model 94 Trunked Radio Remote Control and Model 96 Extended Local Interface, you can install up to ten remote dispatch points, each located up to 2000 feet from the LTR® control station. Each Model 94 Remote Control displays the control station's selected system and group using Zetron's exclusive parallel status update system. The space-saving Remote Control selects scan on/off, as well as conventional or trunked modes. Now you can offer communications system versatility tailored to each customer's unique needs.

LTR® is a registered trademark of the E.F. Johnson Company.

From the leader in communications signaling products -

ZETRON

12335 134th Ct. N.E. Redmond WA 98052
Phone: (206) 820-6363 Fax: (206) 820-7031

Circle (18) on Fast Fact Card

disciplined software expertise. Prior DCS experience is absolutely required. (Why pay an "expert" to learn on your time?)

Selecting the software vendor is critical. There never has been a shortage of self-proclaimed DCS experts.

Typically, software rights are conveyed by a licensing agreement that specifies how the software may and may not be used.

A license reflects how the DCS software vendor is compensated for its efforts. For example, the software may be purchased outright, but this usually is the most expensive option. More often, a fee is paid to the DCS software vendor to provide the software, and then a royalty is paid for each radio sold.

The variety of software licenses is virtually unlimited. Because each OEM radio vendor has special requirements, negotiate for those factors important to your company. Remember, the DCS vendor has similar concerns, so listen and consider them carefully.

Certain software vendors categorically refuse to provide the source code for the DCS firmware to their customers. It is unwise to do business with them.

Without access to documented source code, modification or repairs to the DCS software must be made by the software vendor exclusively and on the vendor's terms. If the vendor no longer is in business, is too busy or otherwise is unavailable, the OEM radio vendor's reputation for having a good-quality radio product may be hurt.

Because the customer ultimately judges the radio quality by how well it works, a reputable software vendor will not deny the OEM radio vendor the option of maintaining its own microprocessor code. Conversely, OEM radio vendors should understand that special skills are required to perform the task.

It is advisable to resist the temptation to partition the project into software and hardware tasks. Remember, DCS design is a double-edged sword. Besides, it is better to have one vendor responsible for the DCS development effort to avoid squabbles among rival factions if problems arise.

Finally, the DCS software vendor needs cooperation from the OEM radio vendor to complete the design. Cooperation and assistance are repaid in customer satisfaction with each DCS radio shipped.

Next: After carefully following the instructions for installing the DCS encoder-decoder into the radio, you are ready to begin the evaluation.

DCS series

Part 1, "Digitally Coded Squelch: What Makes It Work—Or Fail" appears in the November 1990 issue.

Part 2, "Digitally Coded Squelch: Filtering and Decoding" appears in the April 1991 issue.

Back issues of the past two years are available from Intertec Publishing for $5 each, postpaid. Telephone 913-541-6628.

What *Really* Turns You On?

The "Smart Vox", used with any of our audio accessories, will recognize your voice in varying noise - from quiet to deafening - and will consistently turn on your radio . . . but only when you talk. No loss of words at the start of a message, no false keying, no adjustments, no modifications.

How's that for a turn on?

For completely HANDS-FREE, RELIABLE RADIO COMMUNICATIONS, get turned on by our "Smart Vox".





Contact:

Setcom CORPORATION

1400 North Shoreline Blvd.
Mountain View, CA 94043
(415) 965-8020

Circle (19) on Fast Fact Card



PUBLIC SAFETY



FIRE



LOGGING



REMOTE LOCATION

MAN-DOWN



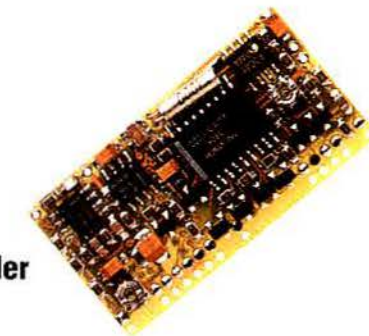
Now, Any Radio Can Call For Help Automatically

Coded Turns Any Two-Way Portable Radio Into a Personal Emergency Alarm

Any radio can have lifesaving Man-Down emergency call capability with the PED-24 encoder/decoder from Coded Communications. It's small enough to fit radios of all sizes and works even if the radio operator has fallen or is unconscious.

- PRE-ALARM TONE prevents false alarms.
- Digitally transmitted (GE-STAR compatible).
- Resets after auto acknowledgement.
- Open mic monitoring option.
- Silent operation option.

Specify Coded's Man-Down encoder/decoder when you order radios.



Coded's PED-24
(actual size)

Coded™
communications

Coded Communications, 2375 Camino Vida Roble, Carlsbad, CA 92009
(800) 228-6367 (U.S. & Canada) • (619) 431-0077 (Local) • (619) 431-1372 (Fax)

© COPYRIGHT 1991 CODED COMMUNICATIONS CORPORATION

Circle (20) on Fast Fact Card

Measuring duplex curves in your own shop

Part 1—Use these step-by-step techniques with test equipment you are likely to have on hand in the shop. The resulting measurements lay the groundwork for preparing duplex operation curves.

By Ernesto A. Alcivar

Professional-quality duplex receivers and transmitters are characterized by *duplex operation* or *TN-RD* curves that specify how much transmitter-to-receiver RF isolation is required, as a function of T-R frequency spacing, to prevent receiver desensitization by the transmitter.

Duplex operation curves are not available for many commercial radios that are pressed into duplex service, in applications where receivers must operate simultaneously with co-located transmitters. Without duplex operation curves to guide system design, system owners must either pay the high price of over-specified duplexers or multicoupler systems or risk poor radio system performance because of desensitization and interference.

Test equipment commonly found in most two-way radio shops and a few inexpensive RF test accessories can be used to produce duplex operation curves for any transmitter-receiver combination. The method is based on simple receiver sensitivity and desensitization measurements that can be used to estimate duplex T-R isolation requirements quickly, in addition to producing the duplex operation curves.

Basic concepts

Duplex system receivers must deliver usable output signals with RF input levels of only *five thousandths of a millionth or a millionth of a watt* (0.5μV) or less. Receiving such weak signals represents a formidable challenge, especially in the presence of carrier and broadband noise from transmitters that may operate at power levels more than 1 trillion times higher.

Receiver desensitization stems from either or both of the following causes:

(1) The transmitter carrier overloads and reduces the gain of receiver RF or mixer stages, or both.

(2) Transmitter broadband noise at frequencies within the receiver passband enters the receiver and decreases its output signal-to-noise ratio.

In both cases, a larger RF signal level is needed at the receiver input to produce a satisfactory signal-to-noise ratio at its output. Successful duplex operation is achieved when carrier at the transmit frequency and broadband noise at the receive frequency are attenuated to the point that they cause negligible receiver desensitization.

The amount of RF isolation required at the receive and transmit frequencies is a function of transmitter and receiver design and transmitter-to-receiver frequency spacing. Transmitters that generate low broadband noise levels require less isolation at the *receive* frequency because they inject less unwanted noise into the receiver. Receivers with high front-end selectivity and large-dynamic-range RF and mixer stages require less isolation at the *transmit* frequency because they tend to be less desensitized by high unwanted carrier levels.

As T-R spacing decreases, transmitter broadband noise level increases and receiver front-end carrier rejection decreases. Thus, more isolation is required to achieve desensitization-free operation at closer T-R spacings.

Duplex operation curves precisely specify how much isolation is required for a given transmitter-receiver pair.

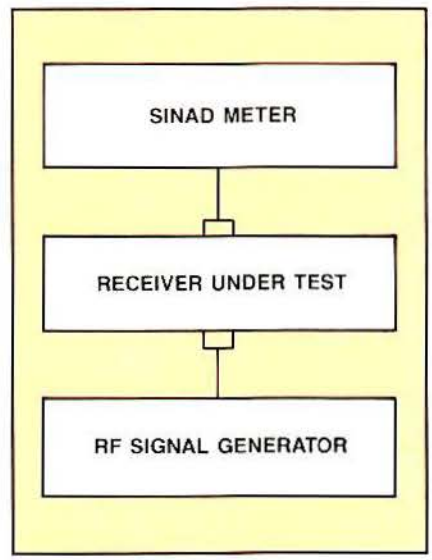


Figure 1. Use this test setup to measure receiver SINAD sensitivity. Set the RF signal generator to produce a test signal at the receiver frequency, with 1kHz modulation at 60% of rated FM deviation. Receiver SINAD sensitivity is the test signal level required to produce 12dB SINAD at the receiver output.

Measuring receiver sensitivity

► *SINAD sensitivity*—Figure 1 at the left shows the well-known test setup for measuring receiver SINAD sensitivity. The RF signal generator is set to produce a test signal at the receiver frequency, with 1kHz modulation at 60% of rated FM deviation. Receiver SINAD sensitivity is the test signal level required to produce 12dB SINAD at the receiver output.

Alcivar has 19 years of practical experience in radio communications systems.

► *Effective sensitivity*—A receiver may not attain SINAD sensitivity when connected to an antenna because noise and interfering signals enter via the antenna along with the wanted signal. If antenna noise is above the receiver noise floor or if an off-channel signal reduces receiver input stage gain, receiver sensitivity will be lower because a higher RF signal level is needed to produce 12dB SINAD at the receiver output.

Effective receiver sensitivity depends on operating frequency and noise level at the radio site. Radio noise is higher at lower frequencies. Consequently, a lowband VHF radio's effective sensitivity can be expected to be worse than that of a UHF radio at the same site. In low-noise rural areas, effective sensitivity approaches SINAD sensitivity. In RF-congested urban areas, it may be many decibels worse than SINAD sensitivity.

Figure 2 at the right shows a practical test setup for measuring effective receiver sensitivity. Noise and interference from the antenna pass through the in-line RF coupler to the receiver with little attenuation. Signal from the RF generator is applied to the remaining RF coupler port. The coupler attenuates the test signal by −10dB to −40dB, depending on frequency and coupler characteristics.

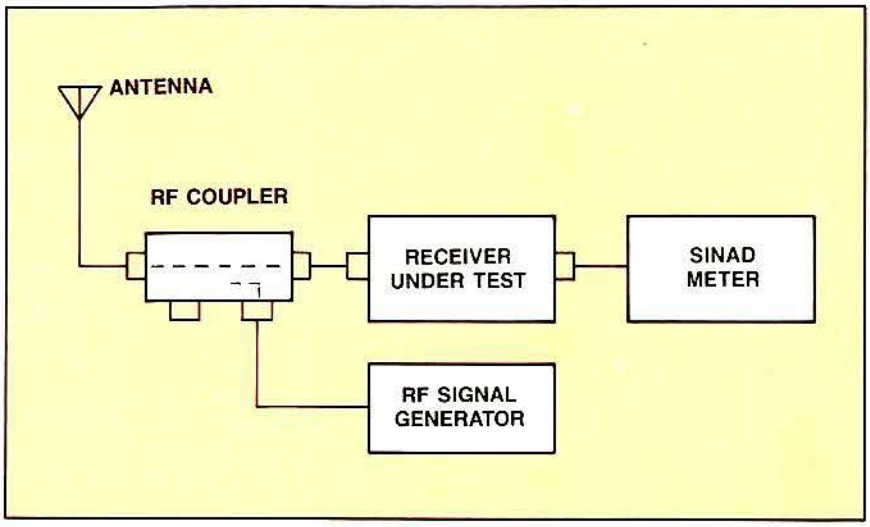


Figure 2. This practical test setup measures effective receiver sensitivity. Noise and interference from the antenna pass through the in-line RF coupler to the receiver with little attenuation. Apply RF generator signal to the remaining RF coupler port. Increase signal generator output until the SINAD meter reads 12dB. Record this level as E_3 μV or P_3 dBm. Effective receiver sensitivity S_e is: $S_e = E_3 \times (E_1/E_2)$ μV or $S_e = (P_3 - L_c)$ dBm. See text for directions for measuring coupler load L_c.

RC-4.....DTMF Remote Control and Site Monitor



Programs with a standard telephone instrument

We use this unit at our Mountain Top RF sites in **Alaska** and it's a proven performer. Compact, low power CMOS design and a high quality metal enclosure. Antenna switching, battery transfer, system monitoring and thermal generator ignition and monitoring.....day after day....it just keeps on working.

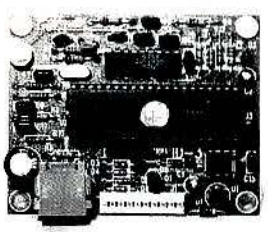
$179

FEATURES

Local Programming
Over-the-Air Programming
4 DPDT Latching Relays
2 Aux Alarm Inputs
LED Enable/Disable
5 Independent Decoders
Metal Enclosure

Relay Functions;
On/Off as Commanded
Momentary On
Single Digit Following
Function Verification
Status Interrogation
Alarm Reporting

CW ID'er



ID-3 is an unprecedented CW ID'er that's quickly and easily programmed with a standard DTMF telephone instrument. Every feature is programmable for your custom setup any number of times and it has enough programmable input logic to satisfy most any system requirement.

Auto ID Interval
Manual ID
Triggered-delayed ID
Polite Hold Off
Inhibit inputs (high or low) for multiple transmitters or links
18 Character Message
Programmable ID Speed and Tone Frequency

$89.95

Northern Controls & Communications

1035 Blair Road, Fairbanks, Alaska 99701 (907) 452-7765 FAX: (907) 456-5175

Circle (21) on Fast Fact Card

The Biggest News About NiCad Batteries Since Their Loss of Memory!

It's HME's New, Very Affordable Charging/Maintenance Systems.

Leading cell manufacturers tell us that NiCad "memory" is a thing of the past—*provided you properly maintain your battery.*

Now virtually everyone can afford to properly analyze and maintain NiCad batteries—with HME's new *System 90* chargers and analyzer/conditioners! That's because the *System 90*'s advanced technology gives you more information about your NiCad, operates more reliably, and costs much less than older analyzer/conditioners.

HME's *System 90*. It's the big news your batteries have been waiting for.



HERE'S HOW AFFORDABLE!

The *System 90* is truly a comprehensive product group. There are twenty different models which charge or maintain 1, 3 or as many as 6 batteries simultaneously.

Keep Your Batteries in Top Condition—Today's NiCads are more predictable, last longer, and charge faster—IF properly conditioned. So don't settle for analyzer-only products. Use the System 90's *microprocessor-controlled IQ plus* stations to Charge, Condition, Analyze and Discharge your battery. An *IQ plus* will do that for as many as 6 batteries, independently and simultaneously—at the lowest prices ever!





Battery Fault Indication—Every HME System 90 model tells you if your battery has particular defects after only 15 minutes! And the comprehensive *IQ plus* combines this feature with an even more thorough diagnostic display.

The Most Thorough Analysis—The System 90's *IQ plus* is an analyzer/conditioner with the most comprehensive digital display in the field. All modes of operation, cycle count, battery fault, voltage and capacity information are *simultaneously* displayed on the LCD information center. HME technology brings you everything you need to know and do—to maintain your NiCads—at the best price ever!



Remember—Conditioners are needed to bring your weak or degraded battery back to health. There's no need to settle for an analyzer without a conditioner—HME's analyzer/conditioner is priced below most other products which only analyze! HME technology brings you everything you need to know and do to maintain your NiCads.

Type	No. of Stations	List Price
System 90 Charger plus multi-sta. fast charger with one "IQ" analyzer/conditioner station	3	$438
	6	644
System 90 IQ plus fast charger with "IQ" analyzer/conditioners on all stations	1	280
	3	537
	6	827

Call for information on additional models.
MasterCard and VISA accepted

Specify battery adapters or type. Hundreds of battery types lodge in HME's stylish adapters with reliable contact bushings and HME's exclusive quick-disconnect system. **If you already own the "other-brand" adapters, the System 90 can use them!** Just tell us what you need when you call in your order.

hme®
HM ELECTRONICS, INC.

NiCad is a registered trademark of SAFT.

Call Today 800-233-6868

Also Available From:
JaBRO Batteries, Inc.
Lisle, IL · 800-323-3779

HM Electronics, Inc., Battery Systems Division
6675 Mesa Ridge Road, San Diego, CA 92121 • (619) 458-1500 FAX: (619) 458-1798

Circle (22) on Fast Fact Card

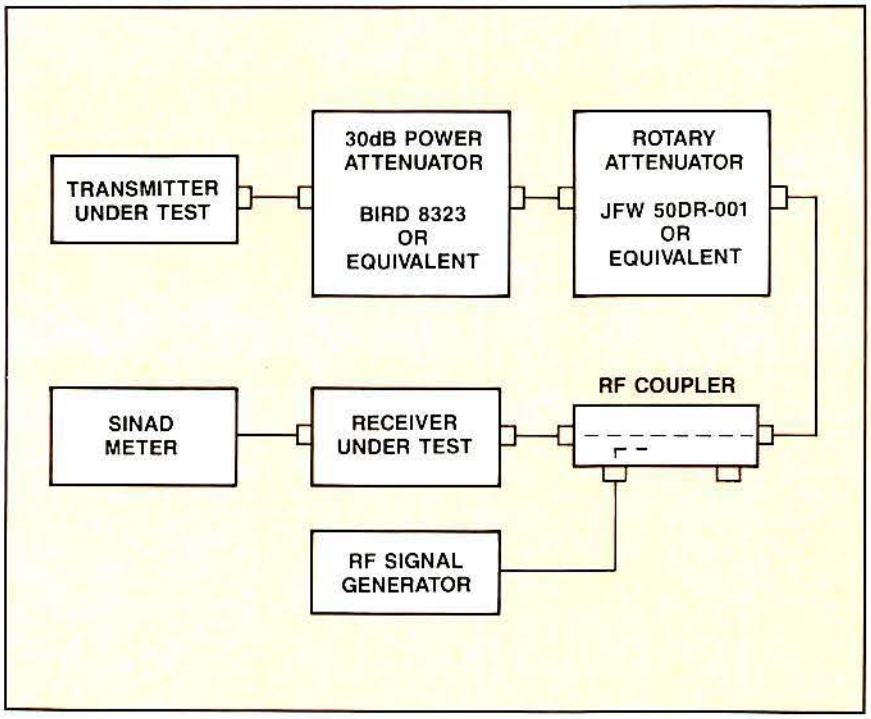


Figure 3. Use this setup to measure receiver desensitization by both transmitter carrier and noise. The receive side is arranged as in Figure 2, but in this case the interfering signal is an attenuated, unfiltered sample of the transmitter output. The setup simulates conditions found in repeater installations where the transmitter and receiver operate with space-isolated broadband antennas.

RF coupler loss must be known to determine sensitivity at the receiver input. It can be measured directly with a signal generator and a spectrum analyzer, or by following these steps:

(1) Measure receiver sensitivity with the setup shown in Figure 1. Record the measurement as E_1 μV or P_1 dBm.

(2) Connect the directional coupler as shown in Figure 2. Temporarily connect a 50Ω termination to the RF coupler's in-line input port.

(3) Increase generator output level until the SINAD meter reads 12dB. Record this level as E_2 μV or P_2 dBm.

(4) RF coupler loss is:

$$L_c = 20\log(E_1/E_2)$$

or

$$L_c = (P_2 - P_1) \text{ dB.}$$

If you plan to use the RF coupler for measurements over a broad frequency range, measure its loss over the entire range of interest.

Measure effective receiver sensitivity as follows:

(1) Connect the antenna to the directional coupler in-line input as shown in Figure 2.

(2) Increase signal generator output until the SINAD meter reads 12dB. Record this level as E_3 μV or P_3 dBm.

(3) Effective receiver sensitivity S_e is:

$$S_e = E_3 \times (E_1)/E_2) \text{ μV}$$

or

$$S_e = (P_3 - L_c) \text{ dBm.}$$

Measuring desensitization

The first step in measuring desensitization is to apply a standard test signal to the receiver input to produce 12dB SINAD at the receiver output. An interfering signal, noise or both then are applied to the receiver input. Receiver desensitization is measured directly as a reduction of output SINAD. A SINAD reduction of 1dB or less is considered acceptable for satisfactory duplex system operation.

The 12dB SINAD reference level is convenient for desensitization measurements because it is the standard for sensitivity and other receiver measurements. Moreover, relatively large SINAD changes occur as receiver input signal or noise levels change within a small range of the test signal that produces 12dB SINAD.

The best SINAD meters for desensitization measurements have a relatively long measurement time constant and a linear SINAD scale, with 12db in the center of the scale. These features reduce measurement uncertainty and accelerate the measurement process.

Broadband T-R isolation

Figure 3 at the left shows a simple setup to measure receiver desensitization by both transmitter carrier and noise. The receive side is arranged as in Figure 2, but in this case the interfering signal is an attenuated, unfiltered sample of the transmitter output. The setup simulates conditions found in repeater installations where the transmitter and receiver operate with space-isolated broadband antennas.

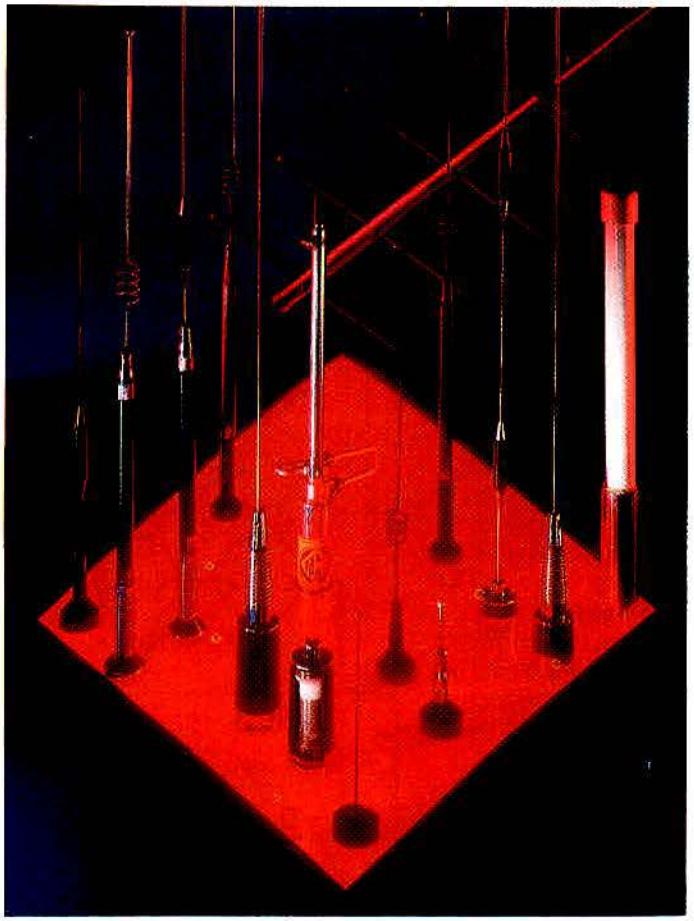
The rotary attenuator controls the amount of interfering signal applied to the receiver. Use an attenuator with no less than 80dB attenuation in 1dB steps.

Try this test with your favorite VHF or UHF repeater:

The best SINAD meters for desensitization measurements have a relatively long measurement time constant and a linear SINAD scale...

(1) With the transmitter off and the rotary attenuator set for maximum attenuation, set the RF generator to produce a standard test signal that causes 12dB SINAD at the receiver output.

(2) Key the transmitter. With 110dB or more total attenuator from transmitter output to receiver input, transmitter carrier and broadband noise are not likely to cause desensitization. The



"Maxrad Makes the Difference"

MAXRAD's *Nonglass* antennas, unlike glass-mounted antennas, allow a 100% signal transfer to the radiating element with no through glass loss.

MAXRAD offers a complete selection of 3dB or 5dB gain antennas for 800-900 MHz, Cellular and SMR applications. Our elevated feed and 3/4" hole mount antennas are available in black or chrome with various cable and connector options to suit your application.

All MAXRAD state-of-the-art products are now warranteed for 2 years.

2495 Pan Am Blvd.
Elk Grove, IL 60007
Voice: (708) 595-3933
Fax: (708) 595-3951
Order: (800) 323-9122

MAXRAD®
State of the Art Antennas

MAXRAD Products Are Represented By:

ASSOCIATED SYSTEMS
(603) 472-2297
Territory Covered: CT, ME, MA, NH, RI, VT

BILL BROWN COMPANY
(404) 939-7075/1395
Territory Covered: AL, AR, DE, DC, FL, GA, LA, MD, MS, NJ, NC, Eastern PA, SC, TN, VA, WV

HAROLD J CURRY SALES CO., INC.
(913) 381-1013
Territory Covered: Southern IL, IA, KS, MO, NE

KENNEDY ENGINEERING
(213) 690-8090
Territory Covered: AZ, CA, NE

MANON ENGINEERING
(206) 827-7449
Territory Covered: AK, HI, Western ID, Western MT, OR, WA, Pacific Trust Territories

MELBY COMMUNICATIONS
(612) 884-7688
Territory Covered: MN, ND, SD, Western WI

R. F. MARKETING
(317) 849-8662
Territory Covered: Northern IL, IN, KY, MD, MI, Western PA, WV, Eastern WI, OH

D. W. SCOTT ASSOCIATES
(713) 351-7420
Territory Covered: TX, OK



Circle (23) on Fast Fact Card

SINAD reading should not change at all.

(3) Observe the SINAD meter and reduce attenuation until SINAD decreases to 11dB exactly. At this point, enough receiver desensitization exists to cause a 1dB reduction of SINAD.

The sum of fixed and variable attenuation used at this point (in Figure 3, approximately 30dB plus variable attenuator setting) is the minimum broadband T-R isolation required to limit desensitization to a 1dB reduction of SINAD.

When duplex operation data are not available from the repeater manufacturer, as is the case with many low-cost products, use the method described above as a simple and inexpensive way to estimate T-R isolation for desensitization-free operation.

Those who favor dual-antenna repeater installations for the sake of economy will discover that a large amount of desensitization may occur with 40dB to 60dB of broadband isolation. In addition, they will discover that a much larger amount of isolation may be required than is possible to achieve with space-isolated antennas.

Space isolated antennas

Figure 4 below shows a setup to measure desensitization in a repeater installation with separate receiving and transmitting antennas. Perform the measurement as follows:

(1) With the transmitter off, increase signal generator output until the SINAD meter reads exactly 12dB.

(2) Without changing RF signal generator output level, key the transmitter and observe the SINAD meter. The SINAD reading will decrease if the transmitter is desensitizing the receiver.

Duplexer-isolated system

Figure 5 at the right shows a test setup for measuring desensitization in single-antenna repeater installation. Insert an RF coupler between the duplexer receiver port and the receiver input. Load the duplexer antenna port with a 50Ω RF load. Desensitization is indicated by a decrease in SINAD when the transmitter is keyed. No desensitization should occur with a duplexer of the correct type and ratings for the repeater and the T-R frequency separation.

Desensitization may occur when the duplexer is connected to the antenna feedline and the transmitter is keyed, but not when it is connected to a dummy load. This indicates that the system has feedline, antenna or intermodulation problems.

In some cases, severe desensitization may occur when the transmitter is keyed, even though the duplexer is tuned to the correct frequencies and is producing the right amount of T-R isolation. In such cases the desensitization usually is caused by transmitter instability induced by an unfavorable cable length. The instability usually can by eliminated by increasing or decreasing transmitter output cable length.

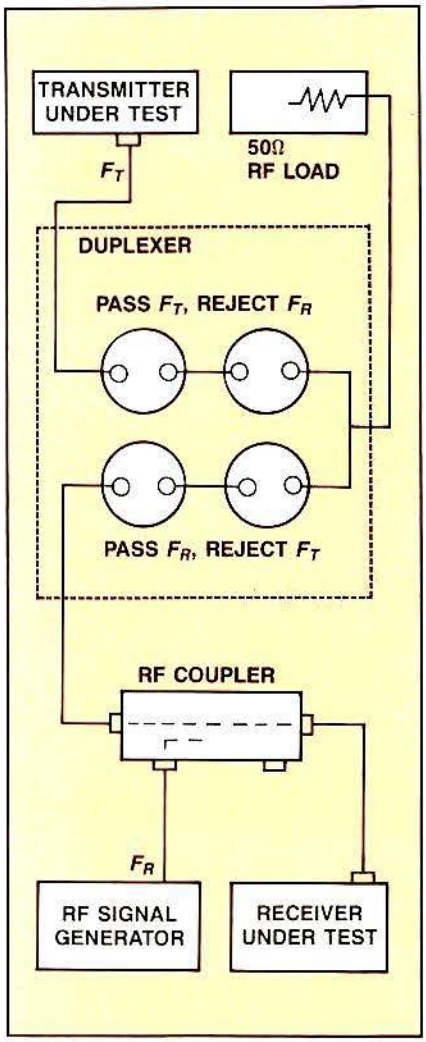


Figure 5. Use this test setup for measuring desensitization in single-antenna repeater installation. Insert an RF coupler between the duplexer receiver port and the receiver input. Load the duplexer antenna port with a 50Ω RF load. Desensitization is indicated by a decrease in SINAD when the transmitter is keyed. No desensitization should occur with a duplexer of the correct type and ratings for the repeater and the T-R frequency separation.

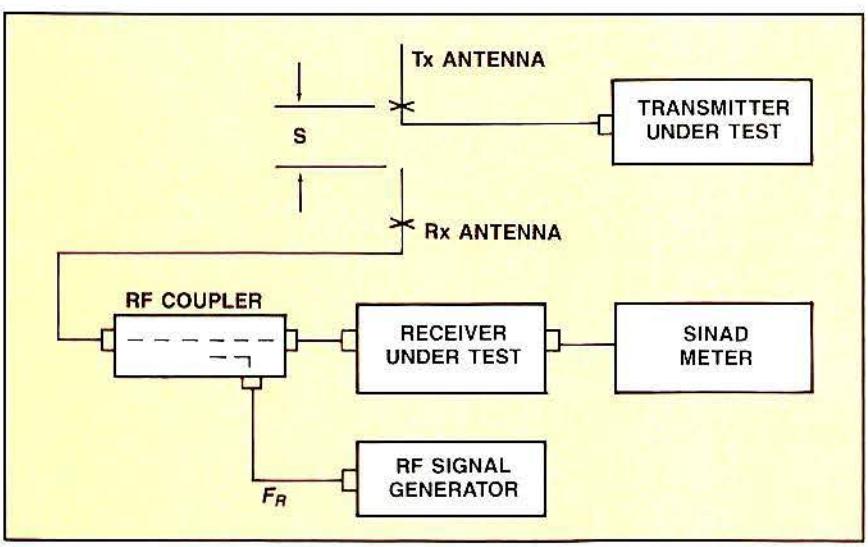


Figure 4. Use this setup to measure desensitization in a repeater installation with separate receiving and transmitting antennas. Perform the measurement as follows. With the transmitter off, increase signal generator output until the SINAD meter reads exactly 12dB. Without changing RF signal generator output level, key the transmitter and observe the SINAD meter. The SINAD reading will decrease if the transmitter is desensitizing the receiver.

Next—Part 2 concludes this series with step-by-step instructions for measuring duplex operation curves.



The Eliminator

The X-Tra Talk™ 12-Volt Adapter For 2-Way Radios.

Now you can operate your two-way portable radio from your vehicle for as long as you want. No worries about power drain or related weakening of signal.

With Centurion's new X-Tra Talk battery eliminator (patent pending), you simply plug the adapter into your vehicle's cigarette lighter or any other 12-volt power source.

You get:

- Maximum power output from your radio
- Extended battery life
- Protection against reverse polarity and current surges
- Compatibility with virtually any popular two-way radio

Why put a drain on your radio battery when you can tap into your vehicle's power source? Save your battery for those requirements away from your vehicle.

The X-Tra Talk battery eliminator. Another example of how Centurion leads the way in new product innovation.

Call us toll-free at 800-228-4563 for the name of your nearest distributor.

THE QUICK CENTURION

CENTURION INTERNATIONAL, INC.
P.O. Box 82846
Lincoln, Nebraska 68501 • U.S.A.

Circle (24) on Fast Fact Card

EXPO SHOW SECTION

IMCE/Spring show preview/guide



Welcome to ***Mobile Radio Technology's*** preshow coverage of the 1992 International Mobile Communications Expo/Spring. Our editors have worked to provide a comprehensive overview of the annual mobile communications show. This section is designed to help you to plan your time at the show at the Las Vegas Convention Center, Las Vegas, Feb. 18-20.

Sections include:

☐ a pull-out map on page 32A, which includes an exhibitor list and exhibitors' booth numbers.

☐ a summary of exhibitors' products and services on display. Exhibitors listed include those who submitted information as of press time.

More than 300 mobile communications equipment manufacturers, distributors and service providers will convene at the Las Vegas Convention Center, and many exhibitors will debut new products and services as they gear up for 1992. Products on display will include antennas, accessories, cellular items, mobile data communications, mobile and portable radios, paging equipment, test equipment, tone signaling equipment, towers and other communications-related items.

For a rundown on what exhibitors plan to unveil and showcase at this year's event, refer to the products and services section beginning on page 33. The names of advertisers in this issue are highlighted in blue ink. Page number cross-references provide quick reference to their respective advertising.

In addition to the new products exhibitors will display in their booths, there will be a "New Products Introduction Center." Here, visitors may review new products.

Sessions will cover mobile communications topics and explore communications requirements and possibilities. Topics will focus on FCC regulatory actions, paging opportunities, antennas, towers and international mobile markets.

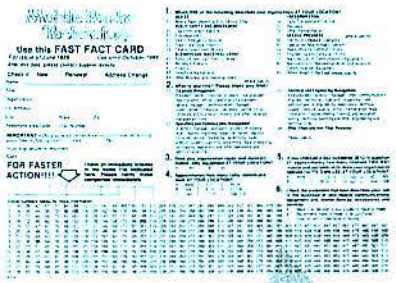
To make the most of your time on the show floor, use the pull-out map on page 32A for guidance. It lists exhibitors and booth numbers. Booths are clearly outlined and aisles are numbered to make it easy to find specific booths. Take the map to Expo.

Mobile Radio Technology will be in booths 1035 and 1036. See you at Expo!

Event: International Mobile Communications Expo/Spring
Dates: Feb. 18-20
Location: Las Vegas Convention Center
City: Las Vegas
Number of Exhibitors: More than 300
Projected Attendance: 5,000 to 8,000
Exhibit Hours: Tuesday, Feb. 18, 10 a.m. to 6 p.m.
Wednesday, Feb. 19, 9 a.m. to 6 p.m.
Thursday, Feb. 20, 9 a.m. to 2 p.m.
Seminar Schedule: Tuesday, Feb. 18, 8:30 a.m. to 4:45 p.m.
Wednesday, Feb. 19, 9 a.m. to 9 p.m.
Thursday, Feb. 20, 9 to 11:45 a.m.
Registration/Hotel Information: 303-220-0600

Products, services

For more information on the products and services listed, fill out and return the Fast Fact Card on page 107. See example below.



XYZ Corporation **Booth 7000**
Existing services
Galaxywide paging, satellite rental, multilingual billing formats.
New products
Coin-sized pager. This unit operates on ambient heat and needs no batteries.
See ad page 310 **Circle 900**

Information listed is accurate at press time, but may be subject to change.

Advanced Computer Controls **Booth 111**
Existing products
PatchMaster 200 radiotelephone interconnect; RC-96 repeater controller.
Circle 300

Advance Label and Tag Booth 118
Existing products
Labels and nameplates for cellular phones, pagers, two-way radios, antennas and other communications equipment; bar code inventory and tracking labels.
New products
Bar code reading and printing equipment; laser printable labels.
Circle 301 See classified ads

AdvanceTec Industries **Booth not assigned**
Existing products
Battery eliminator and chargers; hands-free units for all popular hand-held cellular phones.
New products
Eliminator and chargers for Motorola 8000 and Ultra Classic, Panasonic HP600 and Audiovox Minivox; hands-free units for Motorola Flip Phone, NEC P300, Mitsubishi 3000 and Oki 900.
Circle 302

AER-Aerotron **Booths 527, 529**
Existing products
Communications equipment; base stations; portables.
Circle 303

Air Comm Booth 601
Existing products
Used and reconditioned two-way radios, mobiles, base stations, portables and accessory items including "PL" and paging reeds, channel elements; accessory items for Radius portables.
Circle 304 See classified ads

Alexander Batteries Booth 226
Existing products
Replacement batteries for portable cellular telephones, two-way radios and pagers; battery maintenance equipment.
Circle 305 See ad page 38

AmeriCom **Booth 304**
Existing products
AmeriCom network switch, AmeriCom network manager, RevenueMaster billing package and AmeriCom network cube.
Circle 306

Andrew **Booths 1332, 1334**
Existing products
Heliax coaxial cables and waveguides including connectors, grounding kits, hangers and related accessories.
New products
Easiax tool for LDF5 7/8" foam cables enables precision connector installations.
Circle 307

Antenna Specialists Booth 616
Existing products
Mobile, base station and portable antennas and accessories; site management equipment and Extend-A-Cell line of cellular low-power boosters and high-power repeaters.
New products
Pro-5000 series VHF and UHF mobile antennas feature heavy-duty construction, stable soldered connections and superior weatherproof characteristics. 3dB gain models are available in VHF and 5dB gain versions in UHF in a variety of mounting configurations.
Circle 308 See ad on IFC

APREL **Booth not assigned**
Existing services
Certification testing: DOC, FCC, CSA, UL, MIL-STD; independent laboratory testing: telecom, cellular, radio, paging, antennas, shielding; performance, comparative and question-and-answer testing.
New services
Test methodologies, plans and procedures; Standards and specifications; consulting; research and development; engineering; special studies.
Circle 309

Applied Spectrum Research Booth 1434
Existing products
R.S.D.S. advanced propagation prediction software.
New products
Versions of R.S.D.S.
Circle 310 See classified ads

Astron Booths 1239, 1241
Existing products
Power supplies, inverters and converters.
New products
PI-125W, PI-250W and PI-600W.
Circle 311 See ad page 39

Automation & Electronics Engineering Booth 1215
Existing products
RD series dc remote control units; DP series dc termination panels; RT series tone remote control units; TP series tone termination panels.
New products
Tone remote multiline select remotes; tone remote multichannel remote and termination panel; dc solid-state single- and dual-function termination panels.
Circle 312 See classified ads

Avtec **Booths 1431, 1433**
Existing products
Advanced concept communication exchange and signaling system (ACCESS) integrated radiotelephone console system with color touchscreen. Features include one touch control of radios, telephones, paging and speed dial functions.
New products
Touch terminal (TT) is an improved version of the touch information display used on ACCESS. Unit offers larger screen size, better display resolution, improved styling and convenient operator controls.
Circle 313

Bally Engineered Structures **Booth 1136**
Existing products
Modular equipment shelters.
New products
Membrane roofs.
Circle 314

Band-IT—IDEX **Booth 1254**
Existing products
E.V.A. coated ties; AE200 cable tie tensioner.
New products
Tie-lok ties; ID tagging system; all-purpose band.
Circle 315

Bee Electronics Booths 102, 201
Existing products
Leather cases for two-way radios, cellular phones and pagers in a variety of styles and colors.
New products
Calfskin cases for Fujitsu Pocket Commander cellular phone, Audiovox Minivox cellular phone and Motorola Advisor Pager with built-in steel clip.
Circle 316 See ad page 87

Bendix/King Mobile Communictions Division **Booth 634**

Existing products
E-series VHF and UHF portable radios and accessories; L-series VHF mobiles.

New products
EMV 499 IA UHF mobile operates from 403MHz to 470MHz without degradation in specification; E-series portables offer DES, as well as an eight-character/14-segment alphanumeric display.

Circle 317

Bird Electronic — Booths 1553, 1555

Existing products
43, 4410A, 4304A, 4308, 4381 and 4421 wattmeters; air-cooled dummy loads and attenuators; connectors and accessories.

Circle 318 — See ad page 83

Bomar Crystal — Booths 550, 651

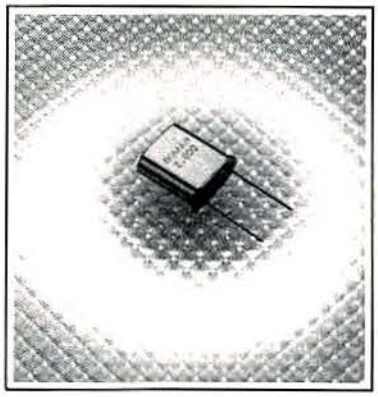
Existing products
GE MPI crystal bank; Motorola pager crystal bank for Bravo, BPR200, Spirit and Minitor I pagers; lowband, VHF and UHF.

New products
Motorola Bravo 900MHz crystals.

Circle 319 — See ad page 34

Yo, Aged Crystals.

Bomar Crystals are 100% aged to exact specifications for totally clean, drift-free reception. Even 48-hour emergency crystals are precisely aged, or Quality Control won't ship them to you. Aging stops crystals from drifting. Adds stability which maintains the frequency you specified—not for months but years. Bomar's high-performance crystals won't drift .001 per cent in one year. We guarantee it. We also guarantee our crystals will outlive the life of the radio. Yo, check it out.



BOMAR
201 Blackford Avenue
Middlesex, N.J. 08846

TOLL FREE FAX:
1-800-777-2197

CALL TOLL FREE
1-800-526-3935

Visit us at IMCE Booths #550 & 651.

Circle (28) on Fast Fact Card

Branco — Booth 539

Existing products
Mobile encoders and decoders; ANI display systems; reeds and active filters for audio tone system; eight-function controller; micro encoder and decoder.

New products
3026A mobile message center; 3027A micro encoder and decoder.

Circle 320 — See classified ads

Cadex Electronics **Booth 1140**

Existing products
C2000 series battery analyzer; C6000 series modular battery analyzer; CVI000 series vehicular battery charger.

New products
C4000 series programmable battery analyzer.

Circle 321

Cal Crystal Lab — Booth 1207

Existing products
Quartz crystals; crystal clock oscillators.

New products
1/2-size crystal clock oscillators.

Circle 322 — See classified ads

Carlson Communications — Booths 1533, 1535

Existing products
Optaphone+ radiotelephone links and rural radio systems.

New products
Optaphone Star multiple subscriber rural radio telephone systems; Waseca Technology/Carlson synthesized UHF telemetry transmitters, receivers, transceivers and high-speed radio modems.

Circle 323 — See ad page 46

Cellular & Mobile International magazine — Booths 1035, 1036

Existing products
Mobile Radio Technology and ***Cellular Business*** magazines introduce a joint effort specifically for the international marketplace. The publication, ***Cellular & Mobile International,*** focuses on key issues and developments pertinent to the mobile RF environment. The circulation of 10,000 predominantly reaches Africa, Australia, New Zealand, Middle East, Far East, South America, Central America and Europe.

Circle 324

Cellular Business magazine — Booths 1035, 1036

Existing products
Cellular Business is the "Journal of Cellular Telecommunications" and the official publication endorsed by CTIA. It is published monthly and provides marketing and engineering information and news of the cellular industry. Readers are cellular professionals, including wireline and non-wireline cellular systems operators; dealers; agents; resellers; engineers; and members of the telecommunications financial and legal communities.

Circle 325

Cellular Wholesalers **Booths 402, 501**

Existing products
Distributors of Audiovox, Fujitsu, Mitsubishi, Motorola, NEC, Panasonic, Technophone, Toshiba, Antenna Specialists, Mobile Mark, Valor, Ora, SMC, Unitech, AdvanceTec and Centurion.

Sheer Genius

Once again, Unipage leaps ahead with new paging innovations.



Innovative paging services can give you the needed edge to succeed in your market. Only Unipage gives you the competitive innovations FIRST!

We were the first company to offer TNPP networking, the first to provide combined voice and numeric retrieval, and the first to give you modular expandability.

Once again, Unipage is the first to expand your paging opportunities with fully integrated Alpha Transcription, FAXpage™, 2400 baud POCSAG, and Automated Attendant services.

Automated Attendant features

We have also just introduced a feature enhancement to our Message Manager system that can eliminate the need for an "on-premises" voice mail system at your customer's office.

When a call reaches an "Attendant" mailbox, it allows the caller to leave a message for the "main desk" or any individual in the company by "extension number", to play one or more "directories" of extension numbers, or to play informative messages.

Each mailbox can notify an individual pager, and can even have a direct DID number. The system also allows messages to be transferred from mailbox to mailbox. Messages left at the "front desk" can be transferred to an individual's mailbox upon retrieval by the receptionist.

2400 Baud POCSAG

While other manufacturers are still struggling with 1200 baud POCSAG, Unipage has already begun testing 2400 baud POCSAG in the field! In a joint effort with two major paging carriers, a pager manufacturer, and a control system manufacturer, Unipage is testing the next leap in paging throughput.

FAXpage ™

Unipage FAXpage ™ will store and forward a printed copy of display messages to selected customers. FAXpage™ stores each customer's messages on hard disk for delivery to the customer's Fax machine at one or more specified times.

Each customer can be programmed for selected message delivery times, and can be personalized with the customer's name at the top of the page.

Alpha Transcription

Unipage Alpha Transcription is the ultimate marriage of the voice mailbox and alphanumeric paging.

The caller to an alpha pager with this service leaves a message in a voice mailbox. The voice message is scheduled to an available operator to be typed. The system automatically schedules activity for up to 15 operators.

Circle (29) on Fast Fact Card

unipage™

1509 Falcon
DeSoto, Texas 75115
(214) 224-3509
1-800-367-2864
FAX (214) 228-1430

© Unipage, 1991

DECIBEL

Dedicated to the Fine Art of Radiation Management!



An Alliance Telecommunications Company

For Solutions . . . FAX your Problems to 1-800-229-4706 or (214) 631-4706

Circle (30) on Fast Fact Card

DECIBEL

Amplifiers

Decibel's new, field-proven amps are the Number One Choice for Cellular, Trunking, Paging and Conventional RF power amplifiers!

Why? Because Decibel creates the designs, the quality and the broad, enhanced line of amps you need!

To solve cellular urban cell saturation problems.

And to meet the high power needs of suburban and RSA cellular plus trunking, paging and conventional systems.

Look at the Decibel line-up!

12, 45 and 65 watt dynamic plug-in cellular amplifiers plus static-to-dynamic modifications of 45-watt Avantek, Harris, Kokusai, Northern Telecom and Motorola amps. Field proven, thousands are now operating successfully!

High power amps for cellular systems now available include 105, 120, 160 and 180 watt dynamic units. And for trunking, paging and conventional systems, Decibel offers 90, 100, 145 and 155 watt amplifiers. All with one or two **built-in cooling fans!**

Features include 100% continuous duty cycle, automatic and manual power cutback, and an output stability of ±1 dB.

Amplifiers carry a 2-year limited warranty, modifications a 1-year.

For more information contact Marketing, Decibel Products, P.O. Box 569610, Dallas TX 75356-9610. Telephone (214) 631-0310. FAX (214) 631-4706.

An Alliance Telecommunications Company

Decibel designs systems that communicate . . . quality!

Decibel Trilectric™ VHF and UHF RF amplifiers and portable amplifier/chargers, now redesigned for top quality, are also available.

Amplifier	Output Power-watts	Frequency-MHz	AMPS	VDC	Power Protection	Application
Modifications*	45	860-900	6	26	Isolator	Cellular, static to dynamic
DBP012D01B	12	869-960	6	26	Isolator	Cellular compatible
DBP045D01B	45	869-960	6	26	Isolator	Cellular compatible
DBP065D01B	65	869-896	9	26	Isolator	Cellular compatible
DBP090CXXA	90	851-960	20	13.8	Isolator	Trunking, paging, conventional
DBP100CA1A	100	851-960	20	13.8	VSWR**	Trunking, paging, conventional
DBP105DA1B	105	851-960	14	26	Isolator	Cellular, high power, dynamic***
DBP120DXXB	120	851-960	14	26	VSWR**	Cellular, high power, dynamic***
DBP145CXXA	145	851-960	38	13.8	Isolator	Trunking, paging, conventional
DBP155CA1A	155	851-960	38	13.8	VSWR**	Trunking, paging, conventional
DBP160DA1B	160	851-960	21	26	Isolator	Cellular, high power, dynamic***
DBP180DXXB	180	851-960	21	26	VSWR**	Cellular, high power, dynamic***

*Avantek = DBPSPAU-G, Harris = DBPSPHA-G, Kokusai = DBPSPKO-G, Northern Telecom = DBPSPNT-G, Motorola = DBPSPMO-G.
VSWR detector reduces power by 6 dB when high mismatch is detected. *Can be used for trunking, paging and conventional.
Note: Customer must specify input power. Cellular models are also available for static performance.



12, 45, 65 watt amps are AT&T, Motorola, Novatel, NT & GE plug-in compatible.

90, 100, 105 and 120 watt amps have a built-in cooling fan.

145, 155, 160 and 180 watt amps have dual built-in cooling fans.

Factory Authorized Warehouses: Antenna Farm, Overland Park KS; **Cartwright Communications,** Cincinnati OH; **Communications Associates,** Joliet IL; **Communications Express,** Clifton NJ; **Communications Works,** Denver CO; **M. Hutton,** Dallas TX, Norcross GA; **Marketronics,** Sunrise FL; **Primus Electronics,** Joliet IL; **Talley Electronics,** Hayward CA, Santa Fe Springs CA, San Diego CA, Phoenix AZ; **Tessco,** Hunt Valley MD, Sparks NV. In Canada, **ECD,** Calgary, Alberta; Niagara-on-the-Lake, Ontario; Laval, Quebec.

Visit us at CTIA
Booth #1836, #1838, #1840

Circle (31) on Fast Fact Card

New products
Oki 810, 830, 891; Panasonic TF800, CM800.
Circle 326

Celwave — **Booth 820**
Existing products
Broadband panel antennas; base, mobile and cellular antennas; receiver multicouplers; transmitter combiners; cavities; duplexers; filters; coaxial cable; and accessories.
New products
PD10183 omnidirectional broadband antenna.
Circle 327 — See ad page 11

Centurion International — **Booths 533, 535, 537**
Existing products
Antennas for two-way, paging and cellular; replacement batteries and Earcom for land mobile use.
New products
X-Tra talk two-way portable radio adapter.
Circle 328 — See ad page 31

CES — **Booth 1308**
Existing products
DTMF encoding microphones and headsets; radio-telephone interconnect devices; fleet management status ID equipment.
New products
RT-1000 repeater controller with interconnect.
Circle 329 — See ad page 7

Childs Antennas — **Booth not assigned**
Existing products
Antennas; mount kits; yagis; base station antennas; rugged ducks.
New products
3dB 806 MF male-female contact antenna; MK ¾ MF male-female contact mount kit.
Circle 330

CNet — **Booth 1514**
New products
Wings wireless network graphics system.
Circle 331

Coded Communications — **Booths 1260, 1262**
Existing products
Wireless data network system products including data modem, base station controller and network controller; ANI products including man-down alarm.
Circle 332 — See ad page 24

Commonwealth Communications — **Booths 1231, 1233**
Existing products
Mark I, Mark II, Mark IV paging terminals; TNPP network active hub; Mark I TC-remote trunk concentrator.
New products
Meridian paging terminal—100,000 subscribers, 96 trunks.
Circle 333

Communications Associates — **Booths 1311, 1313, 1315**
Existing products
Distributor of mobile communications products and accessories, two-way radios, cellular phones and accessories, pagers, and communications test equipment.
Circle 334 — See classified ads

Communications Specialists — **Booth 804**
Existing products
TS-32P CTCSS encoder-decoder; DCS-23 digital coded squelch encoder; SS-32P subaudible encoder; SD-1000 and PE-2P two-tone sequential; TP-38 shared repeater tone panel; DTD-1 DTMF function decoder; HHP-1 hand-held programmer.
New products
TS-64 micro-miniature CTCSS encoder-decoder; PE-4 POCSAG paging encoder; ID-8 automatic Morse code station identifier.
Circle 335 — See ad on BC

Comsearch — **Booths 1230, 1232**
Existing products
Mobile communications analysis platform (MCAP).
Circle 336

Comtelco Industries — **Booth 1140**
Existing products
Base station antennas; yagi antennas; mobile antennas for two-way and cellular systems.
New products
1800 series base-loaded antennas; 1700 industrial series Tuff One antennas.
Circle 337 — See ad page 72



THE
ALEXANDER ADVANTAGE

- Complete line of quality replacement batteries available for today's portable communications equipment.
- Alexander remains the world's leading independent battery manufacturer after a quarter century.
- Alexander sets industry standards for communications, cellular, medical and military batteries.
- Contact your authorized Alexander representative now for our special dealer program.

Alexander Batteries
1-800-388-8314
Call today for your replacement and OEM battery needs

Circle (32) on Fast Fact Card

...POWER UP WITH ASTRON DC TO AC POWER INVERTERS...



Operate the following equipment from any 12vdc source including Cars, Trucks, Boats and RV's ETC.

Laptop and notebook computers
Facsimiles
Battery Chargers for laptop & notebook computers, cellular phones and camcorders.
Computer peripherals, scanners and printers.
Stereos, VCR and TV.
Test equipment, power drills and other electronic equipment.

SPECIFICATIONS

	PI-125	PI-250W	PI-600W
Output power			
30 minutes:	125 watts	250 watts	600 watts
Surge:	200 watts	500 watts	1500 watts
Continuous:	100 watts	200 watts	500 watts
Input Voltage:	10 to 15 VDC	10 15 VDC	10 to 15 VDC
Output voltage:	115 VAC RMS ± 5%	115 VAC RMS ± 5%	115 VAC RMS ± 5%
Output frequency:	60 Hz ± 2%	60 Hz ± 0.01%	60 Hz ± 0.01%
Output waveform:	modified sinewave, phase corrected	modified sinewave, phase corrected	modified sinewave, phase corrected
Efficiency:	90%	90%	90%
Low battery alarm:	10.7 V	10.7 V	10.7 V
Low battery shutdown:	10 V	10 V	10 V
Dimensions (H x W x L):	1.2" x 3.5" x 4.5"	1.5" x 4.5" x 6"	3" x 9" x 10"
Weight:	14 oz.	1.25 lbs.	5.25 lbs.
Protection features:			
Over temperature:	Electronic shutdown	Electronic shutdown	Electronic shutdown
Overload:	Electronic shutdown	Electronic shutdown	Electronic shutdown
Short Circuit:	Electronic shutdown	Electronic shutdown	Electronic shutdown
Reverse polarity	Fuse	Fuse	Fuse

Circle (33) on Fast Fact Card

ASTRON CORPORATION
9 Autry • Irvine, CA 92718 • (714) 458-7277 • FAX (714) 458-0826

Connect Systems Booth 340
Existing products
CS-700, 8200 and 9800 interconnects; 3850 tone panel.
New products
CS-800 interconnect; 6800 auto remote; RT8 rural telephone system.
Circle 338 See ad page 19

CPI Communications Booths 1430, 1432
Existing products
TR series microprocessor controlled tone remotes; TTP series one to 10 frequency tone remote adapters; MR series dc and tone termination panels for Motorola Radius; TSR series trunking system remote for E. F. Johnson 8600 series LTR radios.
New products
Console style LTR remote for dispatch operations; low cost dc-to-tone converter.
Circle 339 See ad page 82

CTI Booth 746
Existing products
SF-65 digital/analog page store and forward unit; Page Master phase II analog/digital paging terminal; DID/SMR 3-5 interface; Mitec-Page alphanumeric paging terminal; Mobile Master phase II mobile telephone terminal; DID trunk manager; Mobile Mater phase II IMTS mobile telephone terminal; TXC-100 and TXC-200 remote base station controller.
Circle 340 See ad page 72

Cushcraft/Signals Booth 922
Existing products
Mobile and commercial antennas for 800MHz to 900MHz including mobile, base and control station models; batteries.
Circle 341 See ad page 43

Cushman/KNS Electronics Booth not assigned
Existing products
6000 series; 7000 series.
New products
7130 and 7140 communication monitors; 6030D; K300.
Circle 342 See classified ads

DAPA Communications Booth not assigned
Existing products
2900 series panels; 4900 series log periodics; 1850 series corner reflectors; 2790 series omni modules.
New products
3900 series high-gain panels.
Circle 343

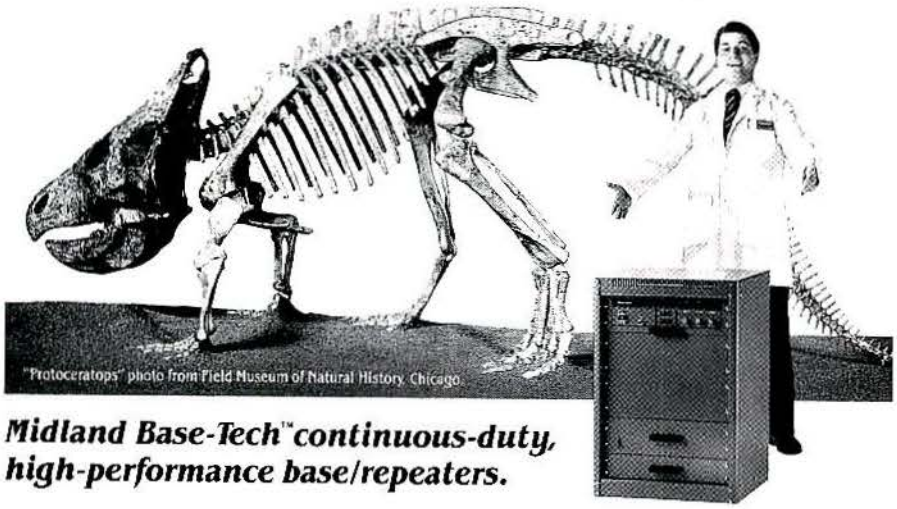
Dataradio Booths 1040, 1042
Existing products
VIS vehicular information system including MRM mobile radio modem, BDLC base station controller and DRC repeater controller; T96 9,600bps telemetry and control integrated radio modem.
New products
VIS LTR-compatible 1,200/2,400 and 4,800bps radio modems for adding data to E. F. Johnson trunked radio systems; VIS mobile data printer.
Circle 344 See ad page 74

David Clark Company Booths 1211, 1213
Existing products
Headsets with push-to-talk adapter cords for mobile and portable radios; voice-activated headsets for portable radios; headset intercom systems with two-way radio interface.
New products
Utility (panel-mount) radio adapter for interface between noise attenuating headsets and mobile radio systems.
Circle 345

DBC Software Booth not assigned
Existing products
Communications Business Management System (CBMS) is an integrated business management system designed for the SMR industry. Features include repetitive billing, inventory, equipment tracking, receivables, payables, sales, service, payroll and general ledger.
New products
CBMS release 4.0.
Circle 346 See classified ads

db Mobile Booths 1367, 1369
Existing products
Lowband, VHF and UHF series antennas; cellular antennas; phone mounts and accessories.
New products
GlasLink series cellular antennas; replacement batteries for land mobile radios and cellular

How to bring your obsolete system backbone up to date on a bare-bones budget:



Midland Base-Tech™ continuous-duty, high-performance base/repeaters.

- Up to 250 Watts in low-band and VHF, 120 Watts in UHF.
- Up to four channels standard, eight optional. Full duplex.
- Switchable Direct/Repeat operation.
- Direct FM modulation, data capable.
- Fully isolated Tx/Rx sections, shielded control cables.
- -100 dB selectivity, -85 dB IM in VHF or UHF without optional preamplifier.
- 12 Watt audio output at 3% distortion or less.
- Pull-out slide-roller drawers for easy service, no patch cables.
- Wide range of options including preamplifiers, tone/digital squelch, remote controls, duplexers, metering panels, power failure alert, and many others.
- We also have a full line of high-quality, 800 MHz base/repeaters, compact multi-channel Syn-Tech XTR™ desk-top dispatch stations, and 1-4 channel full-duplex desk-top repeaters.

Give us a call! *We'll help you modernize your aging system backbone with high-quality stations at reasonable cost.*

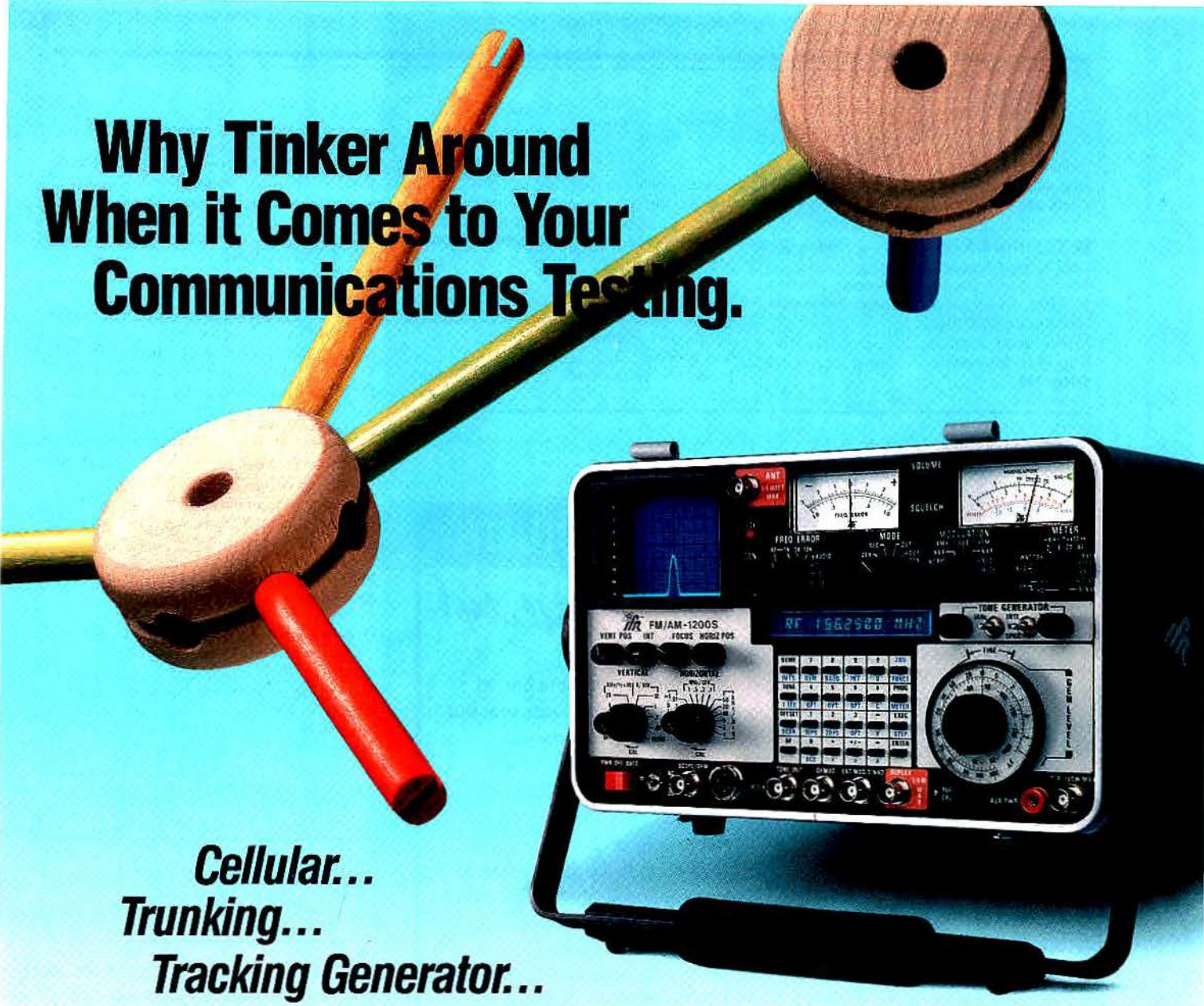
1-800-MIDLAND, Ext. 1690
In Canada, call (416) 287-2320

"the smart way to go" MIDLAND LAND MOBILE RADIO LMR

© Copyright 1991, Midland International Corporation

Circle (34) on Fast Fact Card

Why Tinker Around When it Comes to Your Communications Testing.



Cellular... Trunking... Tracking Generator...

now available with the New FM/AM-1200S

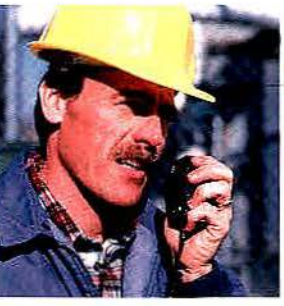
The FM/AM-1200S is still the most feature intensive of all communications service monitors.

See for yourself. The FM/AM-1200S includes a 1 GHz spectrum analyzer, 1 MHz scope, 2 μV receiver, duplex capability, 150 watt power meter, RS-232 interface and numerous programmable functions—all standard in one self-contained, compact and portable unit. With ***three new options,*** the 1200S can now test cellular mobiles; CLEARCHANNEL LTR® compatible mobiles/bases; and duplexers, combiners and isolators.

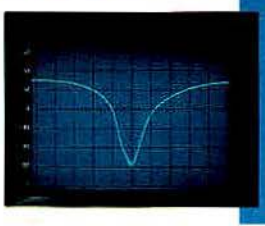
Think of the advantages of having all these features in one package. With the 1200S cellular option you no longer have to be concerned with what type of test interface the radio has. By connecting a coax between the transceiver and test set you are ready to go. When you need to verify a trunked radio, just connect the RF cable, enter the mobile and system information into the 1200S and execute. This now eliminates the need for "add-on" or accessory units to perform cellular and trunked systems testing.

How many times have you wished for a convenient, inexpensive way to observe the frequency response of a cavity or duplexer? The new 1200S tracking generator option will do just that. By connecting two cables, you can observe the frequency response directly on the 1200S' CRT, providing for instantaneous monitoring of filter characteristics.

Where else can you get all this capability in one communications test set? No where! Compare and you'll agree...the FM/AM-1200S ***is*** the logical choice.







Don't tinker around! Buy IFR, the monitors that make the others seem like toys.

IFR SYSTEMS, INC. 10200 West York Street, Wichita, Kansas 67215-8935 U.S.A., Phone 316/522-4981, TWX 910-741-6952, FAX 316/524-2623

CRAFTED WITH PRIDE IN U.S.A.

Circle (35) on Fast Fact Card

CLEARCHANNEL LTR® is a registered trademark of E.F. JOHNSON CO.

phones; leather cases for portable radios and cellular telephones.
Circle 347 **See ad page 47**

DCT: Network Analyzers **Booth 1264**
Existing products
SNA-300B second-generation portable 10MHz to 525MHz; SNA-900B second-generation portable 700MHz to 1,200MHz.
New products
SNA-1000; SNA-B301.
Circle 348

Decibel Products **Booth 908**
Existing products
Acroglas fiberglass base station antennas; MTD fiberglass minimum tip deflection base station antennas; 200 and 400 series metal base station antennas; trunked and cellular systems; panel antennas; 8800 series remote site monitors; RSA Tx combiner and amplifier packages; 450MHz, 800MHz and 900MHz redesigned Tx combiners and receiver systems.
New products
PrismPlus bidirectional amplifier repeaters, 401MHz-to-960MHz, pole-mount, microlite, RF signal distribution, fiber microcell; DB8830TL Sentry remote site monitor with tower light feature.
Circle 349 **See ad pages 36, 37**

D & L Connections **Booth 134**
Existing products
Sells and services the Ericsson GE line; manufactures TTX-8705 transportable full duplex phone, MVS dual-control radio, TM8825 multicontrol unit, speaker mute for Ericsson GE TM 8712, Slowpoke power-down timer and the Board Exchange/Repair program for Ericsson GE mobile line.
Circle 350

DX Radio Systems **Booth 300**
Existing products
RTP series repeaters and base station portable; RTD series radiotelephone links; Exicom series ground-to-air communications.
New products
Paging transmitters.
Circle 351

Dynatech Tactical Communications **Booths 541, 543**
Existing products
Security kits; wireless earphones; miniature microphones; TM-2 throat microphones; EM-1 ear microphones; radio headsets with PTT/VOX radio adapters.
New products
ME-7 palm microphone; S-3 PTT switch.
Circle 352

See *MRT* at IMCE booths 1035, 1036.

EDX Engineering **Booth 145**
Existing products
SHDMAP program for area-wide coverage studies on PC; RPATH program for point-to-point path studies on PC; 3" and 30" terrain elevation database on a single CD-ROM; CVR program.
New products
POP-90 program and 1990 census database on CD-ROM.
Circle 353 **See ad page 76**

E. F. Johnson **Booth 304**
Existing products
LTR/AmeriCom AN 8625 full-duplex mobile; LTR 8602 full-duplex mobile; LTR 8565 2.5W hand-held; UHF LTR 5876 hand-held; Scorpion UHF and VHF hand-held.
Circle 354

EG&G Electro-Optics **Booth 1108**
Existing products
FlashGuard 2000 medium-intensity obstruction warning beacon, FAA approved; OWL high-intensity obstruction warning beacon, FAA approved.
Circle 355

ElectroCom Automation **Booth 904**
Existing products
Mobile data terminals; dispatch consoles; status terminals; data protocol converter.

COMPATIBILITY, RELIABILITY

RTS-100 Rural Telephone System



Provides Telephone Service To Remote Areas Over A Duplex Radio Channel

RFX-1400 Radio FAX Interface



Send FAX Messages From Radio To Radio Over a Simplex Radio Channel

VCS-2100 Simplex Interconnect



The Most Feature Packed Simplex Interconnect Available

VCS-2110 Low Cost Simplex Interconnect



For Use When The Sophistication Of The VCS-2100 Is Not Needed • Operates The Same AS The 2100

FDI-2200 Full or Half Duplex Interconnect



A Full Featured Duplex Interconnect For Systems Requiring No Call Accounting Features

AFX-3200 Automatic FX Line Selector



Automatic Call Routing Based On The First Three Digits Dialed • Supports Feature Group B

PR-5100 Phone Remote



Dial-up Remote • Allows Access To A Radio System From Any Telephone

SR-7110 Simplex Repeater



Converts Any Simplex Transceiver Into A Simplex Store And Forward Repeater

MD-7300 Mobile Decoder



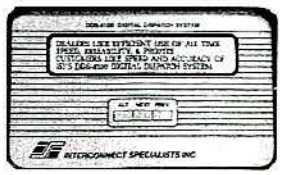
The Mobile Answering Machine • With Caller Identification

Profitability!

ISI offers a complete line of Interconnect products that out last and out perform---

You take your line of products very seriously when your middle name is Specialists. They have to perform to the standards and have the reliability of some of the finest radio systems ever developed, and priced for profitability. With all this line has to offer -- on your next job -- come on over to the FIRST name in Interconnect and have the Specialists on your side.

DDS-8100 Digital Dispatch System
Speed And Accuracy Using Existing Radio And Computer Equipment On SMR And Conventional Systems



INTERCONNECT SPECIALISTS INC.

Phone (407) 332-0533 • Toll Free 800-633-3750
1215 N. CR 427 • Suite 105 • Longwood, Florida 32750
FAX NO. (407) 332-4912

Circle (36) on Fast Fact Card

cushcraft/Signals



ANTENNAS WITH THE BEST CONNECTIONS

ULTRALINK™ CABLE

THE ORIGINAL ALL BRASS MOUNT

Since 1978, Cushcraft/Signals all-brass mount has been the industry standard.

- **Non-corroding**
- **Excellent conductor to ground**
- **Parts will not seize together**
- **Easily removed**
- **Large improved grounding teeth**
- **Soldered ground lug**

UltraLink CABLE

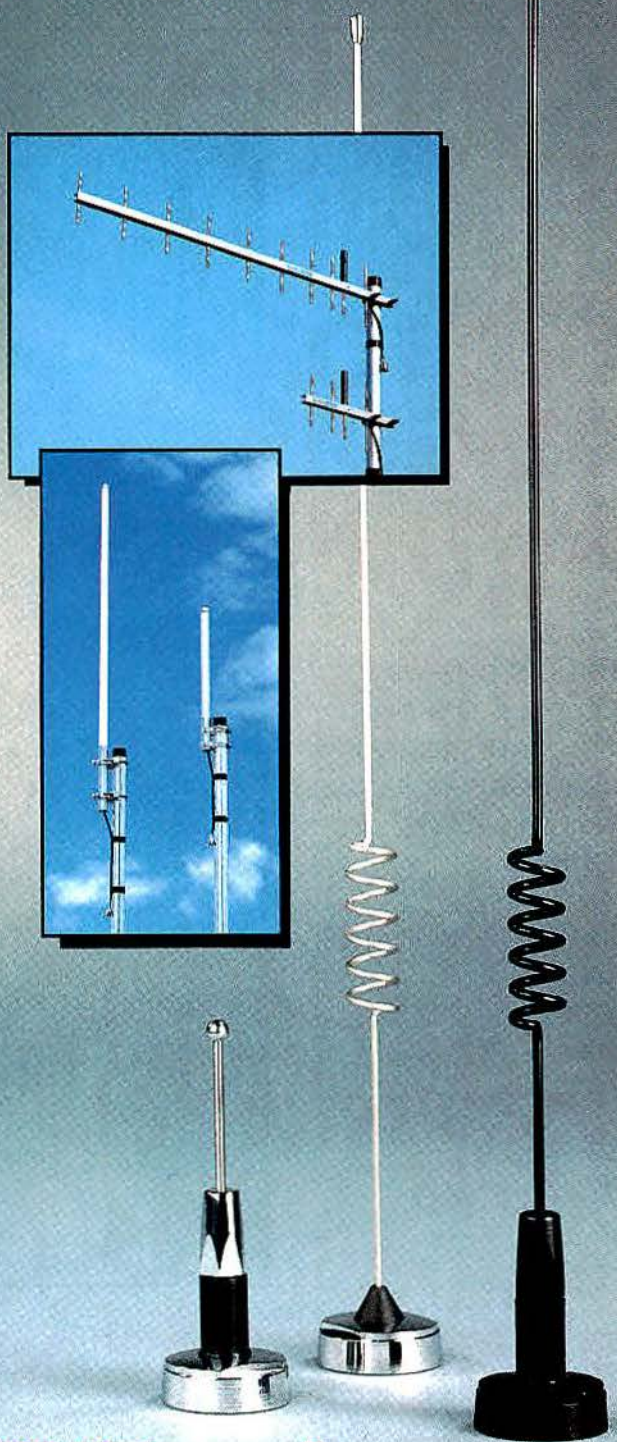
Solves many problems experienced by mobile installers.



- **Low-loss Teflon® dielectric**
- **Withstands high temperature**
- **Fits standard RG58 size connectors**
- **Easily removed dual shields**
- **Used in our base and mobile antennas**



New Catalog



Cushcraft/Signals supplies a complete line of base and mobile antennas. Call us or your favorite distributor for fast delivery or our latest catalog.

1-800-258-3860 • FAX:1-800-258-3868

cushcraft/Signals

48 PERIMETER ROAD, MANCHESTER, N.H. 03103 USA • TELEPHONE: 603-627-7877 • FAX: 603-627-1764 • TELEX: 4949472

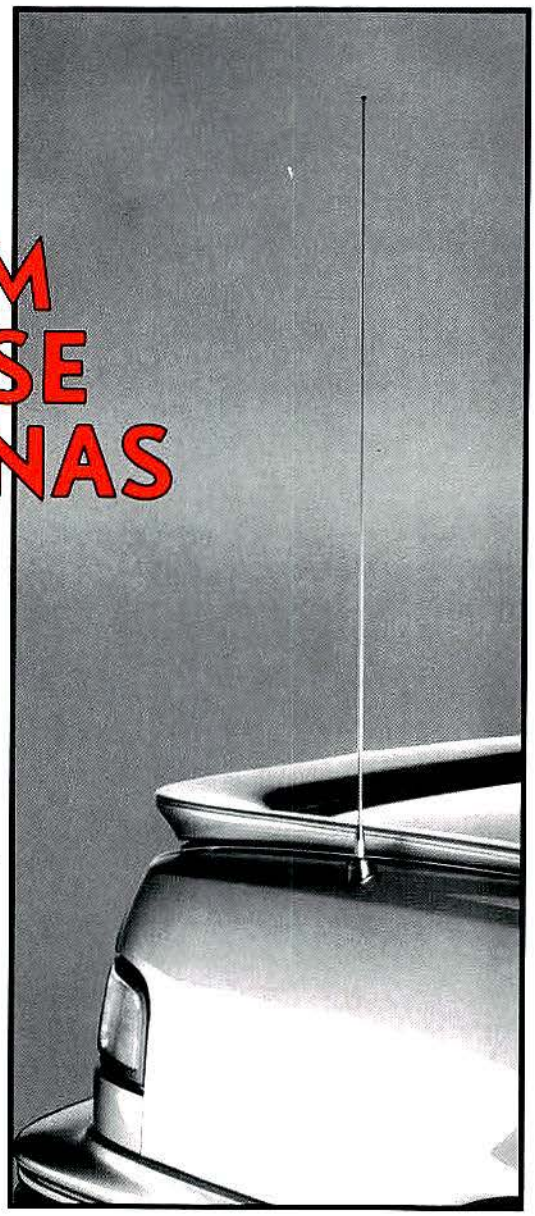
Circle (37) on Fast Fact Card

New products
Mobile data computer; desktop command console.
Circle 356

EMR **Booths 1648, 1650**
Existing products
Isolators; intermod panels; cavity resonators; antenna duplexers; transmitter combiners, receiver multicouplers; antennas.
New products
26700 series high-power paging combiners.
Circle 357

Ericsson GE Mobile Communications **Booths 704, 812**
Existing products
Land mobile communications systems and products.
Circle 358

Falcon Tower Fabricators **Booth 1538**
Existing products
18" to 60" face guyed towers to 1,000'; self-supporting towers to 300 feet; two-way and cellular platforms; mounts; tower accessories.
Circle 359 **See classified ads**



CUSTOM DISGUISE ANTENNAS

STI-CO's two-way antennas are *exact* replicas of the AM/FM antennas supplied with your car—GM, Ford or Chrysler.

Don't blow your cover—buy STI-CO.

The DISGUISE GUYS

STI-CO INDUSTRIES, INC

11 COBHAM DRIVE ORCHARD PARK, NY 14127-0656 (716) 662-2680 FAX (716) 662-5150

Circle (38) on Fast Fact Card

Fanon Courier **Booths 108, 110**
Existing products
Courier Procom VHF and UHF hand-held transceivers; Courier Propage tone and voice paging systems, six and 12 selective paging channels; wired and wireless intercoms; megaphones; PA amplifier systems; paging and talk back speakers.
New products
Courier Procom M-22 2W, two-channel miniature transceiver; Courier Procom M-54 5W, four-channel miniature transceiver; Courier Procom UHF 2W, two channel.
Circle 360

Fibrebond **Booth 650**
Existing products
GFRC and custom-manufactured shelters for the telecommunication industry; complete equipment and power installation services in 20,000-square-foot "clean" facility. Most innovative mobile communications (Cell on Wheels) system in market.
Circle 361

Flash Technology **Booth 1454**
Existing products
FTB-301 medium-intensity beacon; FTB-339 de-operated medium-intensity beacon.
Circle 362

Forest Industries Telecommunications **Booth not assigned**
Existing services
Radio system audits; technical evaluations, system planning and training seminars for radio systems; "Two-Way Transmission" newsletter; forest products radio service coordination; membership services.
Circle 363

Freeman Engineering Associates **Booths 900, 901**
Existing products
PVM paging, voice messaging and networked concentration terminal equipment.
Circle 364

Fujitsu Ten Corporation of America **Booth 926**
Existing products
Citadel series mobiles and portables.
New products
EAR2001-C portable crossband repeater system; BH-2, BH-4, BH-5 nickel-metal-hydride portable radio battery packs; Citadel 56 series data mobiles.
Circle 365

FWT **Booth 509**
Existing products
Guyed and self-supporting towers, turnkey services and installation, communications buildings (fiberglass and all aluminum), mobile buildings, standby power systems and antenna mounts.
New products
Cell Site on Wheels.
Circle 366

Gamber-Johnson **Booths 916, 918**
Existing products
Mobile voice and data communications equipment mounting hardware: DS-series Database; modular mounts for MDTs, MDCs, MCTs, laptop, notebook and pen-based computers; Stackmaster; Shortstack; Stackabout for multiple equipment configurations; message mounts for SMTs; Su-

When every second counts...



TDM-150: Our state-of-the-art, 120+ channel console

Count on the reliability and performance of communications consoles from Orbacom

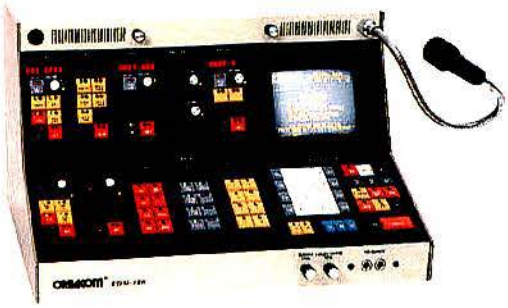
In an emergency, reliable communications are the lifeline for survival. That's why so many communications systems rely on Orbacom's CALIDA and TDM-150 consoles. Their superior performance and solid dependability have been proven in the most demanding applications.

If you need the control flexibility of a big console on a small budget, CALIDA is for you. CALIDA handles 16 channels, includes a multi-format paging and signalling encoder, is completely user programmable, and features a 12/24 hour clock, VU meter, alert tone, crosspatch, service intercom, desk mic with PTT and monitor switches, surge protection, and a wealth of other professional features.

If your service requires a state-of-the-art dispatch console, Orbacom's TDM-150 is the solution. TDM-150 is a custom system, so we'll configure it the way you need it — up to 120 channels or more and 120 positions. TDM-150 uses time-division multiplex (TDM) digital audio processing and complete microprocessor control. Operation is simple and menu-driven. Reliability is ensured through surge protection, self-healing diagnostics, and battery backup. Eight levels of multi-channel radio and telephone patch may be run simultaneously, and an internal paging signalling encoder generates any sequence you'll ever need. Plus the best two-year console warranty in the business.



CALIDA: Big console flexibility for smaller systems



Mini-TDM-150 Desktop Console

Take your pick. CALIDA for professional performance in smaller systems. And TDM-150 for state-of-the-art performance on 120 channels or more. Either way you can count on Orbacom. Our communications consoles are the most reliable you can buy, and have been since 1970.

Call (609) 829-4455 and let Orbacom solve your dispatching problems. Orbacom Systems, Inc., 1704 Taylors Lane, Cinnaminson, NJ 08077; FAX: (609) 829-6980.

ORBACOM SYSTEMS, INC.

Circle (17) on Fast Fact Card

perslide; quick disconnect radio mounts.
New products
No Holes Bored vehicle base assemblies; Landing Pad pen-based computer docking station; PCRadio station IBM PC radio docking station; Floor Master horizontal equipment rack.
Circle 367

General Communications — Booth 1143
Existing products
General Electric mobile radios.
Circle 368 — See classified ads

Glenayre Electronics — **Booth 1202**
Existing products
Advanced wireless communications products and services including paging, voice processing, mobile radiotelephone, RF, mobile data and transportation communication equipment.
New products
GL3000ES "extra small" message management system paging and voice mailbox; MVP-E modular voice processing entry system; Phase III Simulcomm software with 2,400 baud.
Circle 369

Haewa — **Booth 1543**
Existing products
HOS 2200/4400 VHF and UHF portable radios; HOM 2020/4040 VHF and UHF portable radios; HOC 200/300/400 lowband, VHF and UHF portable radios.
New products
HOS/RCC portable phones; HOM TBP talk-back pager.
Circle 370

Hark Systems — Booth 1224
Existing products
SI-550 SMR/DID interface; SS-450EX call distributor; LR-350 least-cost router; Verifier paging decoder; AMT-2 mobile phone terminal; CD-100 click detector.
Circle 371 — See ad page 71

Hartford Concrete Products — **Booth not assigned**
Existing products
Precast concrete equipment enclosure; controlled environment vault; movable curb for utility manholes.
New products
Aluminum equipment enclosure.
Circle 372

Helper Instruments — **Booths 1329, 1331**
Existing products
Electronic test equipment for land and mobile communications including service monitors, millivolt meters, SINAD meters and antenna testers.
Circle 373

HM Electronics, Battery Systems Division — Booth 1109
Existing products
System 90 NiCd conditioners, chargers and analyzers.
New products
System 90 IQ plusH nickel-metal hydride charger and maintenance system.
Circle 483 — See ad page 27

Hughey & Phillips — **Booth 1537**
Existing products
Red lights and strobe lights for towers; obstruction lighting; ice protection.
New products
ICG-225 strobe light.
Circle 374

Hustler — **Booth 1444**
Existing products
VHF and UHF base station antennas; VHF and UHF mobile antennas; mobile cellular antennas; HF mobile antennas.
New products
MC-800 miniature magnetic-mount cellular antenna.
Circle 375

Hutton Communications — Booths 1223, 1225, 1227
Existing products
Regional full line distributor with national strength; more than 50 product lines including Andrew, Bird, Celwave and Decibel.
Circle 376 — See ad pages 78, 79

WIRELESS TELEPHONE

EXTEND TELEPHONE WITH

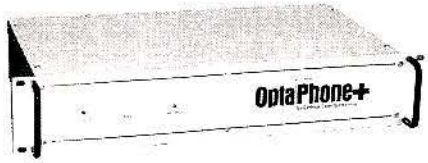
OptaPhone+
by Carlson Communications

OptaPhone+ POINT TO POINT TELEPHONE LINKS

- Install telephone circuits where wirelines cannot go
- Compander standard for toll grade audio
- Frequency synthesized UHF models available soon
- Full speed G-3 FAX operation
- Automatic compensation for loop length eases installation
- Military grade ruggedized construction
- Factory engineered environmental cabinets
- Factory engineered power supplies with battery backup



CALL OR WRITE FOR A FREE BROCHURE





CARLSON COMMUNICATIONS, INC.
655 REDWOOD DRIVE • GARBERVILLE, CALIFORNIA 95440
800-283-6006 • 707-923-2911 • FAX 707-923-2655

Circle (40) on Fast Fact Card

TA-DAHHH!!

"Speaking on behalf of db Mobile, it sounds like their exciting new line of antennas is a winner!"

Ta-dahhh! Introducing performance and durability for greater profit potential!

Ta-dahhh! Introducing easy installation for faster, hassle-free sales!

Ta-dahhh! Introducing sleek, new styling for greater visual appeal!

Ta-dahhh! Introducing the industry's smallest glassmount antenna footprint!



Introducing GlasLink™... db Mobile's breakthrough glassmount cellular antenna!

The innovation you've waited for in cellular mobile antennas is now waiting for you at db Mobile.

Introducing GlasLink™! With high-tech design, no visible hardware, the industry's smallest glassmount antenna footprint, and more.

Also introducing db Mobile—the new sister company of Decibel Products, a leader in radio communications since 1947. So right away, you're riding with a winner.

GlasLink™ from db Mobile. Customers profit from our breakthrough design. And you profit by attracting more customers. That sounds like a winner to us.

Why not price our full new cellular line today? After all, the call is—Ta-dahhh! —toll-free: 1-800-388-2112.

Check GlasLink's innovative features:

- Double-clamped internal strain relief in coupler box eliminates cable breakage
- Copper plated element inside provides clearer communications
- Broad banded, 821 – 894 MHz, no tuning required plus a 3dB gain
- VSWR of 1.6 to 1 or less for excellent energy transfer
- Meets or exceeds all industry specs and even more stringent automotive specs
- Easy installation & Lifetime Guarantee



YOU WIN! WE WIN!

db Mobile

An Alliance Telecommunications Company

Sounds like a winner!

4936 Sharp Street / Dallas, Texas 75247 800-388-2112 / 214-630-2112 FAX: 214-688-1616

Circle (41) on Fast Fact Card

HY-Q International Booth not assigned
Existing products
Quartz crystal products for communications; pager crystals; channel elements recrystalled; complete elements; mobile radio crystals; crystal filters; crystal oscillators.
Circle 377 See classified ads

IDA **Booths 209, 211, 213, 215, 217, 219**
Existing products
40-67 interconnect; dc, local and tone remotes; Spartan and Trojan control heads; Viking 2000 and 3000 hand mics; System 3 Plus; Ric 2000; RPC 2000.
New products
DID 1200; 3100 ANI mic; 800MHz radio SMR car telephone.
Circle 378

IFR Systems Booths 1034, 1037, 1039
Existing products
Communications service monitors and spectrum analyzers.
New products
AN-930 microwave spectrum analyzer; 1600CSA digital cellular test set.
Circle 379 See ad page 41

Interconnect Specialists Booth 1507
Existing products
Telephone interconnects; mobile decoders; rural telephone system; dial-up remote; digital dispatch system; radio fax interface; simplex repeater; automatic FX line selector.
Circle 380 See ad page 42

International Crystal Manufacturing (ICM) **Booth 1435**
Existing products
Quartz crystals; channel elements; oscillators; pagers; portables; test equipment.
New products
FL407 filter; TCXO; VCXO.
Circle 381

JaBro Batteries **Booths 202, 301**
Existing products
NiCd rechargeable replacement batteries for two-way radios, pagers, emergency lighting, camcorders and cordless telephones.
New products
HM Electronics System 90 battery charging and maintenance system.
Circle 382

JEFA International **Booth 1541**
Existing services
Turnkey microwave services: engineering, equipment and installation; turnkey two-way services: coverage, engineering, equipment and installation.
Circle 383

Kenwood USA Booth 526
Existing products
Two-way mobile and portable radios; base stations; repeaters and chargers.
Circle 384 See ad page 49

Kustom Electronics **Booths 1316, 1318**
Existing products
Mobile data communications; integrated system software, DXT and KST 100 mobile data terminals.
Circle 385

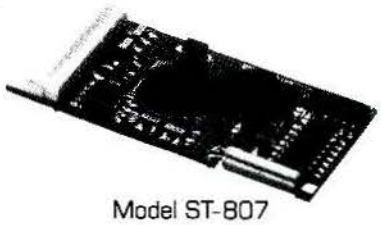
Kyodo West **Booth 1519**
Existing products
Portables; mobiles; base stations and repeaters; cellular phones; paging transmitters; accessories and options available.
New products
KG106 mobile/repeater, mobile/telephone for use in various configurations to meet specific customer requirements.
Circle 386

L & R Communications **Booth 1438**
Existing products
Guyed and self-supporting communications towers including equipment shelters; turnkey site development services; I&M services; emergency restoration services.
Circle 387

Larsen Electronics Booth 322
Existing products
KG series on-glass antennas for two-way and cellular; series and mounting options for NMO, NLA, LM, LA, PO antennas plus base station.

ULTRA-MINIATURE
UNIVERSAL DTMF DECODER

NEW!



Model ST-807

The new ST-807 combines micro-processor technology with advanced, "chip-on-board" assembly techniques to produce the worlds smallest DTMF decoder. Unique features include:

- 1 to 7 Digit Code Capacity
- Individual/Group/All Call
- Remote Reset
- Deadbeat Disable
- Transpond Acknowlegment Tone
- Alert Tone
- E² Prom Programming
- Horn/Call Lamp Outputs
- Only 1.70"L x 0.85"W x 0.25"H [0.15"H without connector]
- Super low dealer price!

$59.95
Dealer Net, qty. 1-9

FOR FULL FACTS, CALL TOLL FREE: (800) 227-0376

Selectone 23278 Bernhardt St., Hayward, CA 94545
(510) 887-1950 • FAX (510) 887-4011

Circle (42) on Fast Fact Card

GET TWO FOR THE PRICE OF ONE!

Get a head start by stopping at our booth number 526

KENWOOD

1-800-950-5005

Circle (43) on Fast Fact Card

New products
KG 2/70 dualband on-glass antenna.
Circle 388 See ad page 75

Lease Acceptance **Booth 116**
Existing services
Leasing programs offered as a financial source for end-users.
Circle 389

Leathersmith **Booth 1532**
Existing products
Leather carrying cases for portable radios and pagers; carrying accessories.
New products
Quick disconnect swivel to be worn without belts.
Circle 390 See ad page 84

LeVoar of California **Booth not assigned**
Existing products
Leather cases for cellular phones, pagers, fax machines, palmtop computers and laptop computers.
Circle 391

Lindgren RF Enclosures **Booth 940**
Existing products
Radio frequency enclosures for the development, engineering, manufacturing and service of mobile communications equipment.
Circle 392

Magellan Systems **Booth 1515**
New products
Five-channel OEM GPS receiver module.
Circle 393 See ad page 73

Magnavox/Nav-Com **Booths 1501, 1503**
Existing products
MAGNAPhone portable satellite telephone; AVLS and GPS navigation; dead-reckoning subsystems.
New products
56K high-speed data satellite telephone system.
Circle 394

Marketronics **Booths 1558, 1560**
Existing products
Distributor for Decibel Products, Antenna Specialists, Midland, Larsen, db Mobile, RFI, Andrew, Coded Communications, Bird and Newmar.
Circle 395

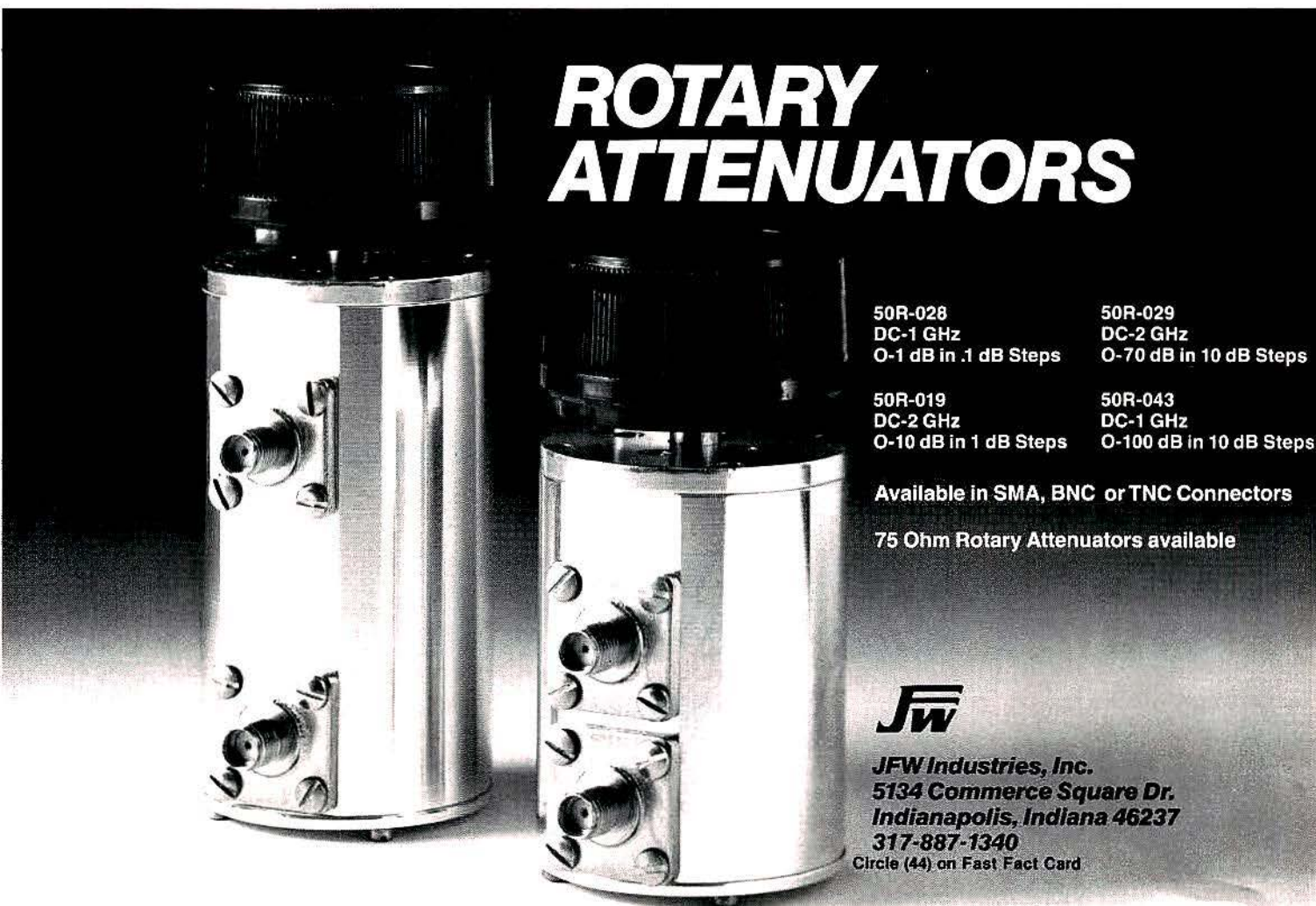
Maxon America **Booth 204**
Existing products
SP-2000 synthesized portables; SM-4000 synthesized mobiles; SP-5000 synthesized portables; CP-0500 crystalled portables; CP-1000 crataled portables; ND series numeric pagers; paging terminals.
New products
ID series numeric pagers; TR-4800 trunking repeater.
Circle 396 See ad pages 57, 86

Maxrad **Booths 1201, 1203, 1205**
Existing products
Land mobile, cellular, SMR and base station antennas, accessories and mounting hardware.
Circle 397 See ad page 29

Meridian Communications **Booths 1364, 1366**
Existing products
Antenna sites; tower space.
New products
Edom Hill; 10 Universal Plaza Building.
Circle 398 See ad page 59

Midian Electronics **Booths 600, 602, 701**
Existing products
UED-1 series encoders and decoders; RT8 series DTMF radiotelephone encoder and decoder; ANI-U multiformat ANI with optional CTCSS encode; TRA telephone-to-radio adapter; CAD system for DTMF, five-tone or digital signaling with optional scrambled version; ID-1 programmable Morse code identifier.
New products
TDS-1 CTCSS or DCS encoder and decoder with optional multiformat ANI.
Circle 399 See ad page 32F

Midland Land Mobile Radio **Booth 726**
Existing products
Syn-Tech XTR series mobiles and portables; Syn-Tech II series mobiles; Base-Tech series base sta-



The Motorola R-2600 Communications System Analyzer.

Comprehensive testing with a soft touch.

NEW TRACKING GENERATOR



Superior testing capabilities with 16 integrated instruments.

- 1 GHz Signal Generator
- Sweep Generator
- Duplex Offset Generator
- AC/DC Voltmeter
- See & Hear Spectrum Analyzer
- Audio Generators
- AF & RF Counters
- Off-the-Air Monitor Receiver
- SINAD Meter
- Terminated Wattmeter
- Signalling Simulator and Decoder
- Signal Strength Meter
- Distortion Meter
- Digital (Storage) Oscilloscope
- Frequency Error Meter
- Cellular Test Option Including NAMPS

Featuring: 30 Test Set-Up Memories; Built in Self Calibration; RS-232 Remote Control; Operator Selectable Special Functions; Help Screens; and a Color Monitor Port. Call ***1-800-543-9191, ext. 1001***

MOTOROLA

Circle (45) on Fast Fact Card

tions and repeaters; CMS trunking systems for mobiles and portables.
New products
800MHz XTR series mobiles 15W to 35W; Syn-Tech II rack-mount and desktop repeaters; Syn-Tech II duplex mobiles; Base-Tech lowband, high-power base stations and repeaters.
Circle 400 See ad page 40

Mobile Mark Booths 350, 451
Existing products
RM series body- and roof-mount antennas for lowband, VHF, UHF and SMR; OW series on-window cellular antennas; CO series clip-on portable antennas; OW series in UHF and VHF frequencies.
New products
DHIY-2500, DHIY-1700 and DHIY-900 high-gain dual-helix antennas; OWSR-1/3/5 on-window cellular with switchable antennas.
Circle 401 See ad page 8

Mobile Radio Technology Booths 1035, 1036
Existing products
Written to keep industry professionals up to date on the latest in equipment, technology, techniques, business developments, legal and regulatory matters, ***MRT*** is recognized as the leading source of technology-oriented industry guidance. Visit our booth to pick up a copy and to sign up for your free magazine subscription.
Circle 402

Modular Communication System Booths 239, 241
Existing products
Ultra-Com 96 microprocessor dispatch console; Ultra-Page programmable encoder; Ultra-Com DT desktop console.
New products
Ultra-Com Pro touchscreen dispatch console.
Circle 403 See classified ads

Motorola Radius Division Booth 404
New products
RNet 9600 radio modem.
Circle 404

Multiplier Industries Booths 647, 649
Existing products
NiCd and alkaline replacement batteries for two-way portable radios, pagers and beepers; custom battery packs; NiCd replacement batteries and battery eliminators for portable cellular phones; NiCd and lead-acid bag phone batteries for transportable cellular phone.
New products
Discovery Power system battery-conditioning and rapid charging system for portable cellular phones. Part #MC-01, MUBC-1000.
Circle 405

MX-COM Booth 104
Existing products
Pvt. Squelch privacy modules; Cypher-MX VSB variable split band scramblers; voice storage and retrieval devices to fit most radios including Motorola, Radius, Maxon, Midland, Relm, Bendix/King and Kenwood.
New products
MX-P1281LP Cypher-MX VSB scrambler; MX-P1184 Pvt. Squelch privacy module for the Motorola GP300; Cypher-MX VSB scrambler for GP300; MX-P10 N-tone sequential encoder and decoder for dispatch and signaling; MX-P12 MSK 1200; 1,200-baud packet modem.
Circle 406 See ad page 9

Nady Systems Booth 1243
Existing products
PRC-1X and PRC-3X Communicator; VHF-30 and VHF-40 two-way radios.
New products
UHF-50 two-way radio.
Circle 407

Newmar Booths 1510, 1512
Existing products
Dc converters; power supplies; battery chargers; inverters; communication accessories.
New products
Vari-Com 20 variable power supply; Base-Com 10RC power supply with built-in transfer relay for an emergency battery.
Circle 408 See ad page 87

NorComm Booths 934, 936, 938
Existing products
Tone signaling encoders and decoders; custom

TONE & VOICE



Checkmate III features:
- Attractive ABS Black Case
- Size 3⅛" x 2 7/16" x 15/16"
- Single "AA" Battery
- Variable Volume Control
- Locking Battery Compartment
- Second Tone Group Call Standard
- Standard 3 Year Warranty

Options
- Automatic Reset
- Low Battery Alarm
- 2-Channel
- Multiple Address
- Vehicular/Desktop Amplifier Charger
- Voice Storage
- First Tone Group Call
- Fixed Alert

The Shinwa Checkmate III is a 2-tone sequential tone and voice pager compatible with many tone and voice paging systems such as Plectron, Motorola, and GE.

SCA
Shinwa Communications of America Inc.
P.O. Box 26407 Oklahoma City, OK 73126
1-800-627-4799 FAX 1-800-759-1799

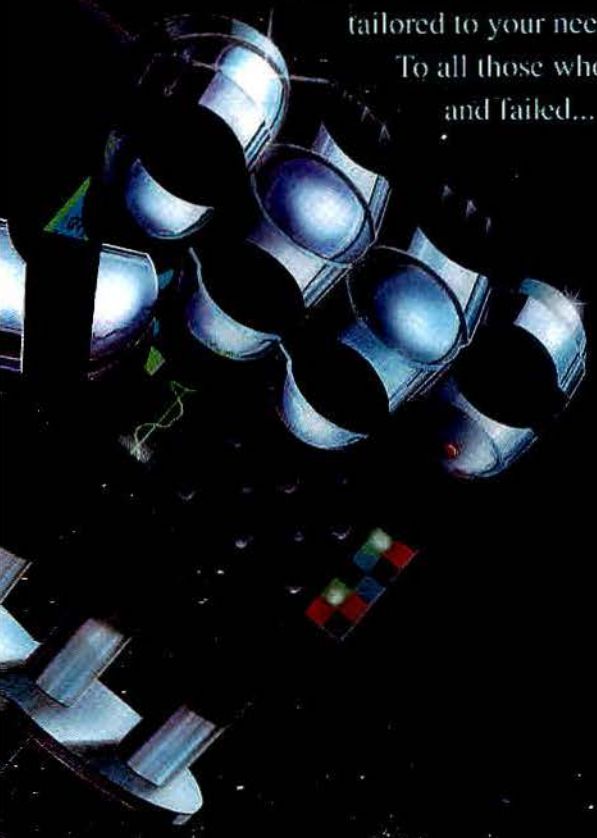
"The Pacesetter in Communications"

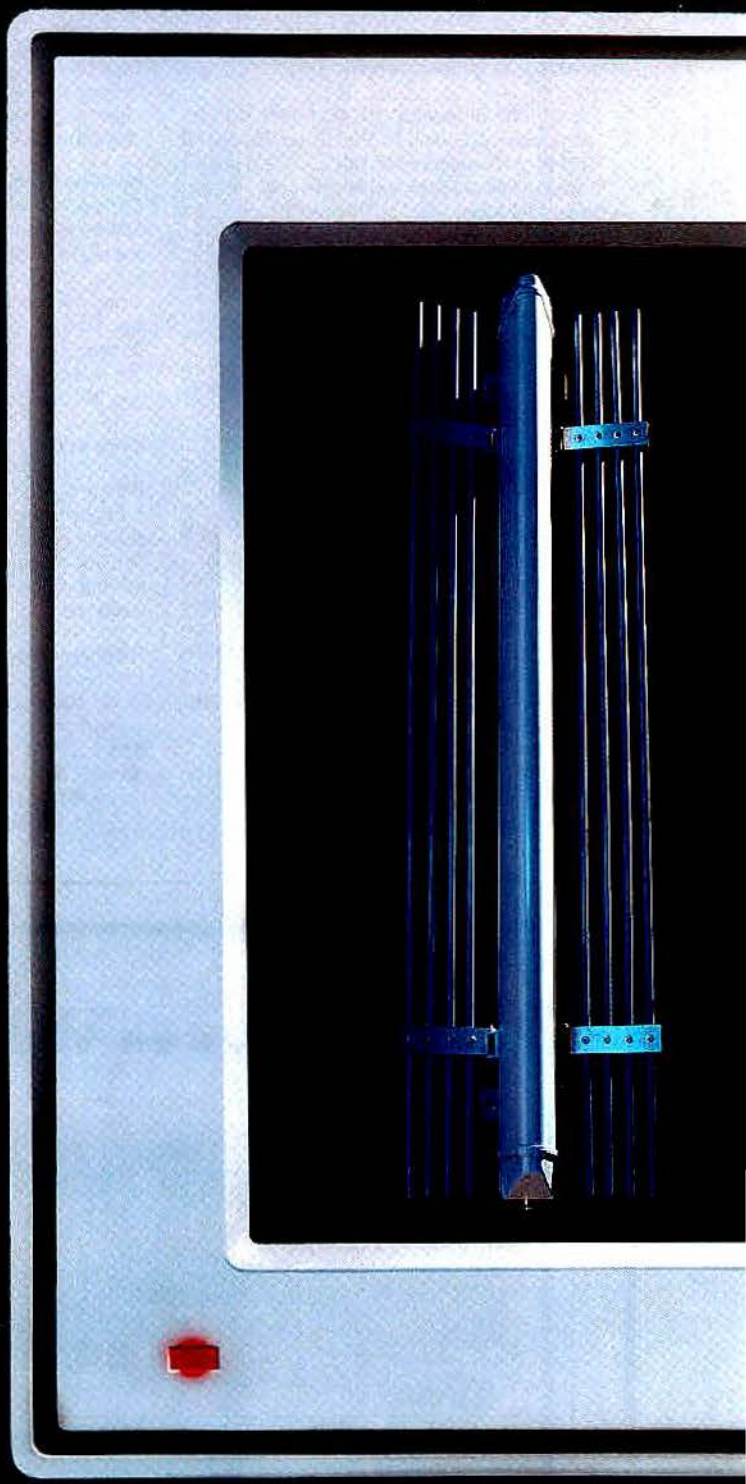
Circle (46) on Fast Fact Card

To All Those Who Have Tried and Failed Sinclair Salutes You...

Others have failed in their quest to develop antennas to serve the 1.85-1.99 PCN frequency bands. However, Sinclair is launching a new line of products that will set the standard in superior technology for the future. It has engineered a series of omni, directional and panel antennas which provide controlled directional coverage and patterns that can be completely tailored to your needs.

To all those who have tried and failed...





A Tradition of Innovation

Hasta la vista, Baby!

SINCLAIR

Sinclair Radio Laboratories Inc., 675 Ensminger Road, Tonawanda, NY 14150
Call 800-288-2763. Fax 716-874-4007 or write for complete product specifications.

Circle (47) on Fast Fact Card

modules for OEM customers.
New products
NC401 DTMF decoder; NC421 DTMF decoder in enclosure; NC409 DTMF ANI encoder; NC410 DTMF ANI encoder for RCCs; NC105 digital coded squelch encoder and decoder; two-tone decode; CTCSS encoders and decoders (tunable and programmable); single-tone encode and decode; burst and filters.
Circle 409 See ad page 81

Orbacom Systems **Booths 1044, 1046**
Existing products
TDM-150 distributed microprocessor communications control center.
New products
TDM-9400 CRT console.
Circle 410 See ad page 45

Pace **Booth 1370**
Existing products
MBT(R) 250 microprocessor-controlled SMT/through-hole assembly and repair system; ST(TM) 50 dual station SMT/through-hole soldering system; SMR(R) 25 Pulse Heat SMD-reflow system; CRAFT(R) 25 and CRAFT(R) 15 surface-mount installation and repair workstations; audio visual training programs.
New products
PRC(TM) 2000 advanced SMT/through hole assembly and repair workstation.
Circle 411

Page-Com **Booth 832**
Existing products
Motorola Radius series.
Circle 412

PanaVise Products **Booths 1511, 1513**
Existing products
Cellular phone mounts, mobile radio mounts, vises and work holding devices for the communications industry; 300 series standard phone mounts; 700 series slimline phone mounts.
New products
PortaGrip hand-held portable phone holder for the car; mobile data terminal mounts: 901 premier series, 960 express series, 970 solo series, 980 tower series.
Circle 413

Paragon Engineering **Booths 1124, 1126, 1128**
Existing products
Original equipment and replacement portable radio and cellular antennas.
Circle 414

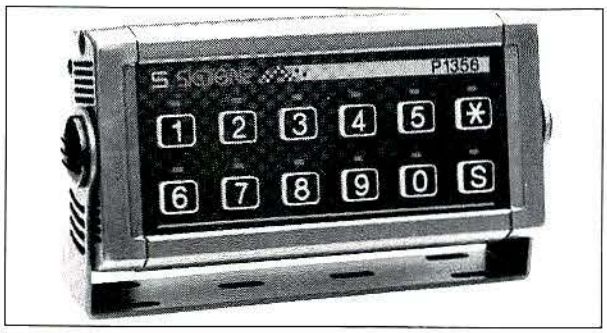
Parkinson Electronics **Booth 351**
Existing products
VC12S multichannel programmable repeater package with power supply and duplexer in a suitcase; RP3 and RPII repeater kit modifications to mobiles; EL5 extended local and remote handset cradle for 8510 and 8712 control stations; VEP repackaging of VE interconnect to GE-Marc V; PT2 power-down timers.
New products
RV8 remote termination panel allows remote control of multifunction and multifrequency radio used as a control station or as a base. Control is by standard dc or tone schemes over one pair of wires, with selections announced verbally in field-programmable words or labels.
Circle 415

Photocomm **Booth not assigned**
Existing products
Kyocera solar electric panels; DuraVolt solar electric panels; B.O.S.S. photovoltaic controls; solar batteries.
New products
DuraVolt DV25 integral frame; Solaradio enclosure.
Circle 416

Pipo Communications **Booths 902, 1001**
Existing products
DTMF encoder.
New products
Model ANI 3.2 high-speed signaling; PK series; P-7 and P-8 series; PP series.
Circle 417

PolyPhaser **Booth 1424**
Existing products
Coaxial lightning protection products; telecommunication protection products; ac-dc power protection products; grounding products.

Say it...without a word.



P1356/21 with back lit rubber buttons and rugged metal case

What is Status Reporting

- Status reporting allows vehicle/driver status messages to be sent to the dispatcher with the push of a button, without the need for voice communications from the driver.

No More Wasted Time

- Status reports are sent in the blink-of-an-eye automatically when a channel is available, and automatically acknowledged to ensure the message gets through, just by pushing a button.

Improve Fleet Management

- Identification, status, and selective calling provide the dispatcher with fleet management tools needed to dramatically improve dispatch efficiency and control.

Works on LTR®Trunking

- Sigtone's LTR®Smart version makes operation on LTR® systems completely reliable. The P1356 knows exactly when a handshake has occurred, so there are no "lost" messages. Sigtone's unique and proprietary "Digital Analysis" decoding technique allows our decoders to work reliably at S/N levels as low as 0db, where speech becomes almost impossible.

Other Features

- ANI, emergency alarm modes, silent status interrogation, time-out-timer, horn honk, hidden mic input, and tone blanking are some of the other features available. A P1356 system can be implemented on your existing VHF, UHF, 800/900 MHz conventional or trunked radio system.

Sigtone® Inc.
225 So. Swoope Ave Suite 105
Maitland, FL 32751
Toll Free 1-800-525-8663 FAX: 407-628-5820

SIGTONE®

Making Your Radio System Do More For You™

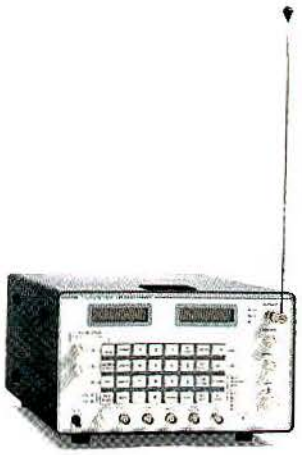
LTR® is a registered trademark of EF Johnson Company.

Circle (48) on Fast Fact Card



A. Model CT300

- *Johnson LTR® encode and decode*
- *POCSAG, NEC, GOLAY*
- *DTMF encode and decode*
- *GE Mark V*
- *5/6 tone Sequential*
- *DCS, off the air*



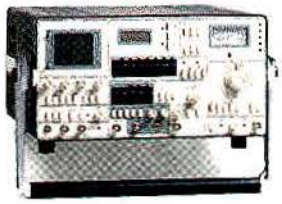
B. Model CT2100

- *Rugged and reliable*
- *Bench quality...field portable*
- *High resolution dual LCD displays*
- *Microprocessor driven*
- *Memory storage*
- *Battery operated*



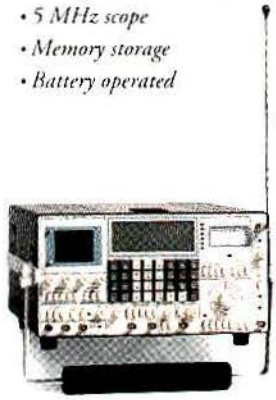
C. Model CT2101

- *Rugged and reliable*
- *Bench quality...field portable*
- *Microprocessor controlled*
- *5 MHz scope*
- *Memory storage*
- *Battery operated*



D. Model CT3000S

- *Full featured spectrum analyzer*
- *Modular construction*
- *Off-the-air modulation counter*
- *Analog watt meter*
- *Oscilloscope*
- *RF Sweep*
- *Audio synthesizer*
- *Audio voltmeter*



E. Model CT5100S

- *110 dB dynamic range spectrum analyzer*
- *True duplex operation*
- *Tone and digital signaling decode and encode*
- *Plain English LCD*
- *Stored settings*
- *Self diagnostics*

We thought you'd prefer multiple choice.

As part of the mobile communications industry, you have testing needs. But your requirements may differ greatly from your competitor. That's why Wavetek offers a variety of communications service monitors.

Our complete line of test equipment ensures you'll have no more or no less testing capabilities than you need. So call Wavetek today at **1-800-245-6356** or (317) 787-5721. Wavetek. Your best choice in communications test equipment.

Circle (49) on Fast Fact Card

WAVETEK

New products
Three port bulkhead panel assembly; IS-LC180 bi-directional, ac power protector; IS-PLHW-120-30A hardwire, 30A, ac power protector; IS-MD75LFZ microwave down conversion coaxial protector.
Circle 418 See ad page 81

PowerTek Industries **Booth not assigned**
Existing products
CMI-990 mobile cellular data workstation.
Circle 419

RaCoTek **Booths 1420, 1422**
Existing products
Mobile data communications services; SMR affiliate network.
Circle 420

RadioMate **Booths 239, 241**
Existing products
Lightweight and noise-attenuating headsets for portables, mobiles and base stations; SwitchMate, a radiotelephone interface.
New products
Series 9000 palm security microphone; mini in-line amplifier and push-to-talk case.
Circle 421 See classified ads

Radio Systems **Booth 200**
Existing products
PR60/460 crystal-controlled submersible portable radios; PR-1605 series synthesized 80-channel submersible portable radios; RadioPass person-down alarm system; transportable weatherproof repeaters.
New products
PR7077 special forces tactical hand-held radio, 60MHz to 88MHz with full band operator usable RF bandwidth and built-in microprocessor-controlled antenna tuning unit for maximum talking distance capability across entire band.
Circle 422

Ramsey Electronics **Booth 1038**
Existing products
Com-3 service monitor.
New products
PTS-1 pager test set and digital code box; SN-1 SINAD meter.
Circle 423

Ranger Communications **Booth 1340**
Existing products
UHF and VHF portable radios; mobile radios; base stations; repeaters; digital paging transmitters; mobile repeaters; SMR trunking mobiles; rural telephone systems.
Circle 424

Reach Electronics **Booths 1012, 1014**
Existing products
2VR152 VIP highband tone-and-voice pager; 2VR32 VIP lowband tone-and-voice pager; 2VR153 VIP highband monitor pager; 2VR82 SCA tone-and-voice pager; 2TYE3 Courier dial-access paging terminal; 2IDYE1 Liaison dial-access paging terminal; 2TE7 L'Page manual two-tone encoder; 1IMDC1 silent dispatch system.
Circle 425

Relm Communications **Booth 604**
Existing products
RSP500B, RSP400-Plus portable radios; RMV60B, RMU45NB, RML60-Plus mobile radios; LMV2548-Plus mobile radio; RFH252NB, RH256NB, TRH202, TRU152 mobile radios; Utili-Com UC202 portable radio; Micro-com MCMHIIA tone-and-voice pager; WH, WU, WS series repeaters and base stations; DU, RDPL series duplexers; and other LMC products.
New products
Mini-Com Plus SLV40, SLU25 mobile radios; Mini-Com Plus PTV56, PTU46 portable radios.
Circle 426

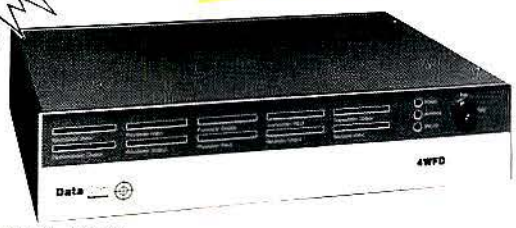
R.F. Industries/Neulink **Booth 426**
Existing products
RF connectors; adapters; attenuators; cable assembly; transmit and receiver boards; crystal-controlled and wireless data acquisition communications products.
New products
DCL-9600 series 9,600 baud wireless modem, asynchronous or synchronous with software; DCL-900 series 900MHz synthesized Tx and Rx units.
Circle 427

EXCEPTIONAL WIRELESS TELEPHONE PRODUCTS

DataCom's PhoneLink/DataLink

SPECIAL INTRODUCTORY PRICE $1995.00

DATACOM
Quincy, Illinois 217-222-0160



IDEAL FOR:
- Remote locations and sites
- Emergency communications
- Permanent or temporary services
- Mobile Phone communications

OPTIONS:
- Leased Line Replacement
- 2 or 4 Wire Circuits
- UHF-VHF-Microwave-Laser
- Analog or Digital Signal Processing
- Spread Spectrum 902 MHz - 5 GHz
- 12 Volt DC & Solar Power

217-222-0160
217-222-0912 (FAX)
DataCom, Inc.
524 N. 30th St.
Quincy, IL 62301
Circle (50) on Fast Fact Card

HOT AIR TOOLS
LEISTER HOT AIR EQUIPMENT

NEW!

ESD SAFE de-soldering and soldering with the leister labor 'S' HOT AIR TOOL



TRAINING VIDEO AVAILABLE

Electronic Temperature Adjustment from **68°-1202° F.** Air volume adjustment from **0-150** litres per minute.

For soldering and de-soldering of all SMD and thru hole components.

OVER 500 NOZZLES AVAILABLE

ASK FOR FREE BROCHURE MO277

BW brian r. white co., inc.

313 HENRY STATION ROAD
UKIAH, CA 95482 (707) 462-9795
FARMINGDALE, NJ 07727 (908) 938-2700

DISTRIBUTOR INQUIRIES WELCOMED

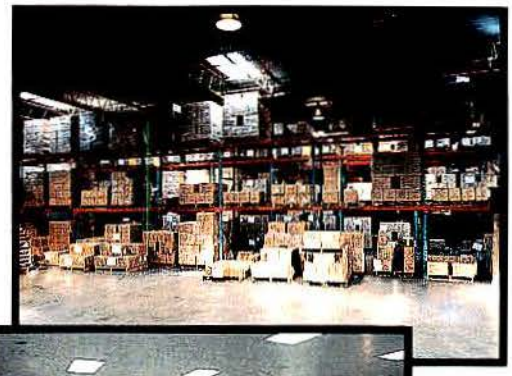
Circle (51) on Fast Fact Card

MAXON PUTS IT ALL TOGETHER...A TOTAL COMMITMENT TO COMMUNICATIONS!



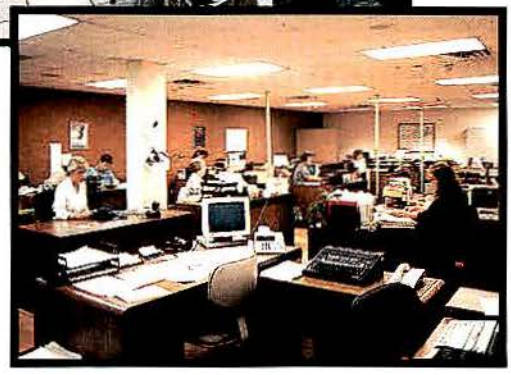
2 YEAR WARRANTY!

Product & Parts Inventory





Repair and Technical Support



Sales Support

The SP-2000 Series

An exciting new 10 channel Synthesized Portable Radio from MAXON. Compact, rugged die-cast chassis with built-in features found in more expensive radios. Backed by a 2 year parts and labor factory warranty.

MAXON offers full sales and technical support for a complete line of portables, mobiles, pagers and accessories from its headquarters in Kansas City, Missouri.

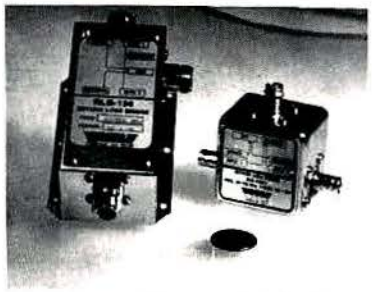
Call MAXON today for an Authorized Dealer near you!
1-800-821-7848

"Maxon – A World of Communications"

maxon®

Maxon America, Inc.
10828 NW Air World Drive
Kansas City, MO 64153
816/891-6320 FAX: 816/891-8815

Circle (52) on Fast Fact Card



Return Loss Bridges

RLB150 bridges are a high accuracy low cost solution to SWR measurements. They can be used with spectrum analyzer/tracking generator for swept SWR measurements. EAGLE RLBs have these features:

- **Frequencys: .04 Mhz to 1.0 GHz**
- **RF reflected port**
- **High Power rating: Five watts**
- **Rugged construction**
- **High Directivity: up to 45 dB**

Model RLB150B1 .04-150 MHz.....$259.00
Model RLB150N3B 5-1000 MHz....$349.00

FREE application note: *"High Performance VSWR measurements"*, call and ask for it!

EAGLE
WICHITA

P.O Box 9446 (316) 942-5100
Wichita, KS 67277 Fax:(316) 942-5190

Circle (53) on Fast Fact Card

EXPO

Richardson Electronics **Booth 502**
Existing products
RF power transistors, modules and electron tubes for two-way radio repair.
New products
Amperex 3-500Z power triode features a heavy graphite anode for high intermittent overload, zirconium-coated anode for extended life, and 18-month, 3,500-hour warranty; semiconnector cross-reference disk includes cross-reference and pricing information for replacement semiconductors for most two-way radios, available in 3½ and 5¼ formats.
Circle 428

Ritron **Booth 718**
Existing products
RPM line of programmable radios in VHF and UHF; Jobcom JBX portables in UHF and VHF; repeaters; interconnects; telemetry systems; Telenexus telephone line extender; data links.
New products
Patriot series portable radios, 5W, programmable, 10 channels, UHF and VHF; JBX series portable radios, 2W, crystal-controlled, UHF and VHF.
Circle 429

Rohn **Booth 122**
Existing products
Guyed towers; self-supporting towers; fiberglass equipment shelters; concrete equipment shelters.
Circle 430

Rules Service Company **Booth 141**
Existing services
FCC rules 0, 1, 2, 5, 13, 15, 17, 18, 19, 21, 22, 25, 73, 74, 76, 78 ,87, 90, 94, 95 and 100.
New services
FCC rules Part 97.
Circle 431

Sabre Communications **Booth 1562**
Existing products
Design, manufacture and installation of towers and equipment shelters for cellular, microwave, broadcast and others. Special applications for the communications industry, foreign and domestic governments, and military and civil entities.
Circle 432

Scala Antennas **Booths 1320, 1322**
Existing products
Paging, sector and omni antennas for cellular; omni and directional antennas for point-to-point, MAS, communications and trunking.
New products
Panel antennas for cellular sectors and quasi-omni trunking arrays.
Circle 433 **See ad page 67**

SCA—Shinwa Communications of America **Booth 1324**
Existing products
X mobiles for VHF, UHF and lowband; FDT series for VHF and UHF; crossband repeater; SR001 scanner.
New products
Pocket pen pager (numeric).
Circle 434 **See ad page 52**

Scientific Dimensions **Booths 1412, 1414**
Existing products
Slide mounts; stack rack system (enhanced); SDI-7000 MDT mount; series 5000 cellular pedestal mount; series 6000 portable phone mount; Goosnek flexible cellular phone mount; mounting brackets.
New products
SDI-7000 mobile data terminal mount with tilt and swirl; laptop computer mount; decor cover SDT-1700.
Circle 435

Schlumberger Technologies **Booths 551, 552**
Existing products
4031 portable communications test set; 4040 precision radio test set; 6910 precision test receiver; 4922 radio code analyzer.
New products
4015 communications monitor.
Circle 436 **See ad page 17**

SEA **Booth 944**
Existing products
175 series 150MHz-to-174MHz narrowband ACSSB mobile and portable radios, base and repeater station; model 225 marine HF/SSB; and model 156 marine VHF FM radios.

Pressure Situation! . . . Perfect Solution



ProTalk



Radio &Telephone Voice Alarm

Protects you against Intrusion, Equipment Failure, Process Upset, Power Loss, etc . . .

- Crystal clear digitized voice messages
- Completely field programmable
- 8 inputs, 4 outputs, expandable to 64 and 32
- Dials up to 16 numbers in 2 directories
- Easily installed, cost effective

Ask about our full line of digitized voice alarm systems, emergency shutdown systems, and telecommunication products. Dealer inquiries welcome.

Call **Toll Free 1-800-268-2646**

BE **BARNETT ENGINEERING LTD.**
(403) 255-9544 FAX (403) 259-2343

Circle (54) on Fast Fact Card



Take in all the sites.

If you're scouting for antenna site locations, take a look at our newest—10 Universal City Plaza. The tallest structure in the area, it provides coverage of the San Fernando Valley, Glendale and Burbank.

If you need to serve the Bay Area, our new site at Crystal Peak covers the Pacific Coastline from Santa Cruz to Monterey, South Santa Clara County and the greater San Francisco area.

Add these two new sites to our catalog of properties that span Southern California from the Mexican border to Santa Barbara, and it's easy to see that no one is as accommodating as we are.

And if you're looking for extra attractions like secure facilities, standby power, air conditioning, and towers engineered to support large microwave dishes, as well as conventional and trunked community repeaters, look no further than Meridian Communications.

As always, Jack and Rich Reichler are ready to be your personal guide to the best in sight.

Meridian Communications
23501 Park Sorrento, Suite 213A, Calabasas, CA 91302-1355
(818) 888-7000 • Fax (818) 888-2857

Circle (55) on Fast Fact Card

New products
220MHz-to-222MHz ESP500 series narrowband ACSSB trunking and conventional mobile radios, base and repeater stations.
Circle 437

Selectone — Booths 800, 802
Existing products
ST-25 voice encryption; tone signaling; remote controls; CTCSS, DCS, two-tone sequential, DTMF and burst-tone encoders and decoders; shared repeater panels; dc remote controls; ANI systems; ST-40 hyperdyne radiotelephone interface.
New products
ST-20 and ST-26 voice encryption modules.
Circle 438 — See ad page 48

Shure — Booths 1017, 1019
Existing products
ModuLink 590T, 885, 890TT microphones; 404 series hand-held microphones; 515 series gooseneck microphones; 450 and 522 desktop microphones.
Circle 439 — See ad page 32E

Signalcrafters — Booths 1333, 1335, 1337
Existing products
Signaling products including status, ANI, selective calling, computer-aided dispatch, CTCSS and LTR trunking products.
New products
S1530 multivariable signaling encoder and decoder; A1458/20 ANI display and decoder unit; P1356/21 LTR-compatible status repeater; S1654 low-level status repeater.
Circle 440 — See ad page 54

Sinclair Radio Laboratories — Booth 832
Existing products
SRL-480, SRL-488, SRL-410, SRL-441 and SRL-310 antennas; RTC trunking combiner; MR mobile duplexers; duplexers; isolators; filters; receiver multicouplers; tower-top amplifier.
New products
SRL-90 antenna; SRL-410 and SRL-470 panel antenna; high-power isolator.
Circle 441 — See ad page 53

SMC Electro-Mount — Booth 1408
Existing products
Mounting hardware for cellular, two-way and other mobile communications equipment including pedestal, flex and slim mounts compatible with a large selection of specialized mounting plates.
New products
VMS-A and VMS-B mounting systems for computers and transportable cellular phones; LBS-06, 08 and 10 leather mount covers; VCC-A and VCC-B console-mount systems for combined mobile communications equipment.
Circle 442

SoftWright — Booth 1805
Existing products
Terrain Analysis Package PC-based computer software and digital terrain data for calculation of radio field-strength contours, database managers for intermodulation studies and design of point-to-point microwave systems including coax, waveguide, county boundaries and antennas.
New products
Databases for all airport and radio tower locations in United States.
Circle 443 — See classified ads

Spectrum Communications — Booths 1415, 1417
Existing products
Repeaters, base stations, RF link receiver and transmitter; paging transmitters; amps and power supplies; monitor receiver; portable transmitter; rack mounts and assembly; railroad test set; 1W to 150W for 66MHz to 88MHz, 136MHz to 174MHz, 216MHz to 280MHz, 406MHz to 512MHz, and 806MHz to 960MHz.
Circle 444

Spectrum Management Systems — Booth 143
Existing products
SMR chart space negotiations; terrain based 40/30dBu contours; shadow map or line contour propagation studies; intermod analyses; SMR loading records; MAS frequency selection; microwave path studies; two- and three-dimensional terrain renderings; FCC research; on-line access to

HIGH PERFORMANCE PRESELECTOR-PREAMP

The solution to most interference, intermod, and desense problems in repeater systems.



- 40 to 1000 Mhz tuned to your frequency
- 5 large helical resonators
- Very high rejection
- Low noise—high overload resistance
- 8 db gain—ultimate rejection >80 db
- GaAs fet option (above 200 Mhz)
- Cast aluminum enclosure
- N, BNC, and SO239 connector options

Typical rejection:
±600Khz @ 145 Mhz: 28db
±1.6 Mhz @ 220 Mhz: 40db (44db GaAs)
± 5 Mhz @ 450 Mhz: 50db (60db GaAs)
±20 Mhz @ 800 Mhz: 65db
±20 Mhz @ 950 Mhz: 70db

AUTOMATIC IDENTIFIERS

- Up to 8 EPROM programmed messages
- Adjustable audio, speed & interval timer
- "ID over voice inhibit"
- Low power option
- Modular design
- Message selection via binary input—TTL levels
- Size: 2.7 x 2.6 x 0.7"



Model ID-2B

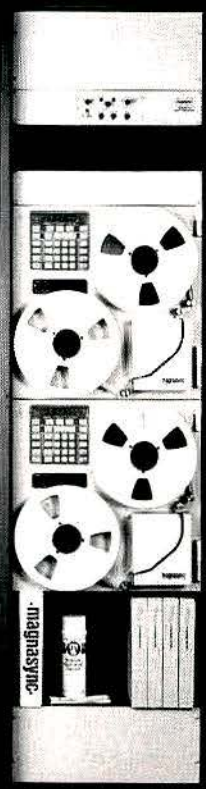
The ID-2B provides required station identification without troublesome diode programming. The "ID over voice inhibit" circuitry allows for courteous operation by not allowing an ID until the next squelch closing.

ID-2B Wired/Tested $99.95 ID-2B-LP Low Power $109.95

GLB ELECTRONICS,INC.
151 Commerce Pkwy., Buffalo, NY 14224
716-675-6740 9 to 4

Circle (56) on Fast Fact Card

THE SPECIALIST PLUS
REDUNDANCY
RELIABILITY
RESPONSE



Featuring:
- 100% REDUNDANCY
- UNPRECEDENTED FLEXIBILITY
- COMPLETE MICROPROCESSOR CONTROL
- UNPRECEDENTED RELIABILITY
- UNPRECEDENTED REMOTE CAPABILITIES
- AUDIO VOICE SEARCH
- ACTIVITY STATUS/MONITOR
- CASSETTE COMPILER/TALKING CLOCK
- BUILT-IN DIAGNOSTICS
- LOW MAINTENANCE

magnasync®

1135 Mansfield Avenue Hollywood, California 90038
Telephone: 213/962-0382 800/366-3564

Circle (57) on Fast Fact Card

SMR Networking . . .

Call Routing As You've Never Seen It Before:

With a Trident CR-355, affordable cellular-like call routing is available for your LTR® trunking system. It operates like any other DID adapter, with one important difference . . . Interconnect Networking!

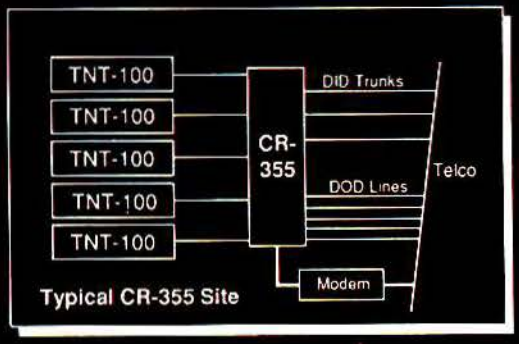
Efficient and Compatible: The CR-355 mates with a universal TNT-100 logic and interconnect controller that can be fitted to any manufacturer's LTR® trunking system. Its features are DID, Least Cost Routing, No Answer Transfer and a billing port to charge for those networked calls.

Real Cellular-Like Roaming: When a mobile roams into another service area, by accessing dial tone the TNT-100 will speak a friendly greeting message to welcome them onto the new system. All roaming information that takes place is transparent to the roamer. Any incoming call will now ring him in the new service area.

Versatility: With 3 DID ports, 5 DOD ports, 5 repeater ports and many feature option packages, one CR-355 allows flexibility to large and small system owners. The use of existing telco lines helps for cost efficiency PLUS the existing mobiles need not be modified to incorporate the networking. Networking between Johnson and Uniden sites is a reality.

No Limits to Roam: There is no limit as to how far a customer can roam when almost everyone can afford a CR-355!

The CR-355 gives you networking capability like you've never had before, together with compatibility, low cost and a user-friendly operating system. For more information, **call 1-800-798-7881.**



Typical CR-355 Site

Trident Micro Systems

LTR® is a registered trademark of E.F. Johnson Co.
Photograph by Jay Brenner

10221 Slater Ave., Suite 103, Fountain Valley, CA 92708
(800)798-7881 ■ (714)549-5206 ■ FAX (714)549-2129

Circle (58) on Fast Fact Card

complete 800MHz and 900MHz database.
Circle 445

Standard Communications — Booth 218
Existing products
HX-240, 340 and 440 series portables; GX-1500, 2000 and 3200 series mobiles; RP-70 series repeaters.
New products
GX-3030T mobile trunking radio; HX-580T portable trunking radio.
Circle 446 — See ad page 65

Standard Crystal — Booth 500
Existing products
Quartz crystals for pagers, radios, telemetry and OEM applications; channel element re-crystaling.
New products
Crystals for Uniden, Panasonic and NEC pagers.
Circle 447

Sti-Co Industries — Booths 546, 548
Existing products
Disguised mobile two-way antennas, including fender-mount lowband, highband, UHF and broadband models; cellular look-alike VHF and UHF antennas; low-profile transit antennas in highband, UHF, 800MHz and 900MHz frequencies; special use antennas; couplers; tuners; dual matched systems.
New products
Custom fender-mount disguised antennas for 1992 models: Olds 88 and 98 (G98), Pontiac Grand Am (GGA), Pontiac Bonneville (GPB), Buick LaSabre (CCL), Buick Roadmaster Sedan (RMS), Buick Roadmaster Wagon (CCL), Buick Skylark (GSK), Ford Crown Victoria (FCR), Ford Taurus (FTA), Mercury Marquis (FCR) and Mercury Sable (FTA); available in lowband, highband, UHF and broadband.
Circle 448 — See ad page 44

Tad Radio of Canada — Booths 1145, 1147
Existing products
M8 VHF and UHF wideband mobiles with 99 channels; MD150 mobiles in VHF and UHF with 40 channels.
Circle 449 — See ad page 80

Tekk — Booth 144
Existing products
PCI-150A 1W and one-channel VHF; PCI-VOX 1W and one-channel VHF; TS-200 2W and two-channel VHF; TS-470 2W and two-channel UHF; KS-220 5W and four-channel VHF; KS-550 5W and four-channel UHF; SM-300 and 400 speaker mics; DC-600, 800 and 900 three-hour desk chargers.
New products
Terminator 5W and two channel VHF.
Circle 450

Telewave — Booths 740, 742, 841, 843
Existing products
Low loss combiners; hybrid combiners; crossband couplers; power splitters; receiver multicouplers; preselectors; amplifiers; broadband wattmeters; alarm panels; isolators; cavities; duplexers.
New products
M101-220 five-channel, 220MHz combiner; TC-804 ceramic enhanced cellular combiner; TC-860 five-channel, cellco trunking combiner; M101-450-IT-3PN expandable band pass-notch combiner.
Circle 451

Telex Communications — Booths 1142, 1144
Existing products
Ear-Mike series, including the EM-200, EM-150, EM-Swat and EM-fire/Hazmat; industrial-grade headsets from featherweight to high-noise attenuation; vehicle intercom system.
New products
EM-300 miniature Ear-Mike designed for covert operations.
Circle 452

Tessco — Booth 446
Existing products
Mobile and base antennas; cellular batteries; cellular accessories; ac and dc power products; power and hand tools; workbenches; soldering equipment; shop supplies; wattmeters; oscilloscopes; service monitors; frequency counters; laptop computers.
New products
Fluke scopemeter; Ungar SMT soldering station; Harger ground bars; Helper SWR meter; Tektronix 2205 oscilloscope; Edsyn hot air workstation; Biddle earth ground resistance tester; Toshiba 2000 laptop computer.
Circle 453

TPL Communications — Booth 302
Existing products
Mobile and repeater amplifiers; lowband, midband, VHF, UHF, 800MHz, power level up to 500W; mobile adapters; towertop amplifiers.
New products
Paging transmitter; VHF and UHF, power levels up to 350W.
Circle 454

Transcrypt International — Booth 346
Existing products
Voice privacy and signaling modules; kits for mobile and portable radio for 20-400 series voice privacy modules, 2700 series CTCSS/DCS modules, 2800 series five-tone signaling modules, 20-250/260 series Flashcall digital signaling (MDC/GE compatible), T-CAD system, 2100/2300 series cellular phone scramblers; voice privacy kits and signaling kits for Motorola, Bendix/King, Midland radios and portables.
New products
Fleet Management Controller, TR 30-280, can be fitted to any mobile radio (trunked or conventional) to provide single-button status reporting, base call, unit and group call, ANI and emergency; CX-2100 cellular voice privacy unit protects cellular telephone calls from eavesdroppers using radio receivers tuned to cellular radio frequencies.
Circle 455 — See ad page 5

Trident Micro Systems — Booths 1158, 1160, 1162
Existing products
TNT-100 logic controller; M-500 airtime logger for Motorola; RVL-5200 remote site controller; MAC-10 mobile audio compandor.
New products
CR-355 DID call router; CR-115 DID slave.
Circle 456 — See ad page 61

Trylon Manufacturing — Booth 1336
Existing products
Titan series light-duty, self-supporting towers; fall protection systems for cable and rail; Titan series light-duty, guyed towers.
Circle 457

TX RX Systems — Booth 522
Existing products
Multicouplers; signal boosters; duplexers; filters; pre-amplifiers; RF system products; associated hardware.
Circle 458

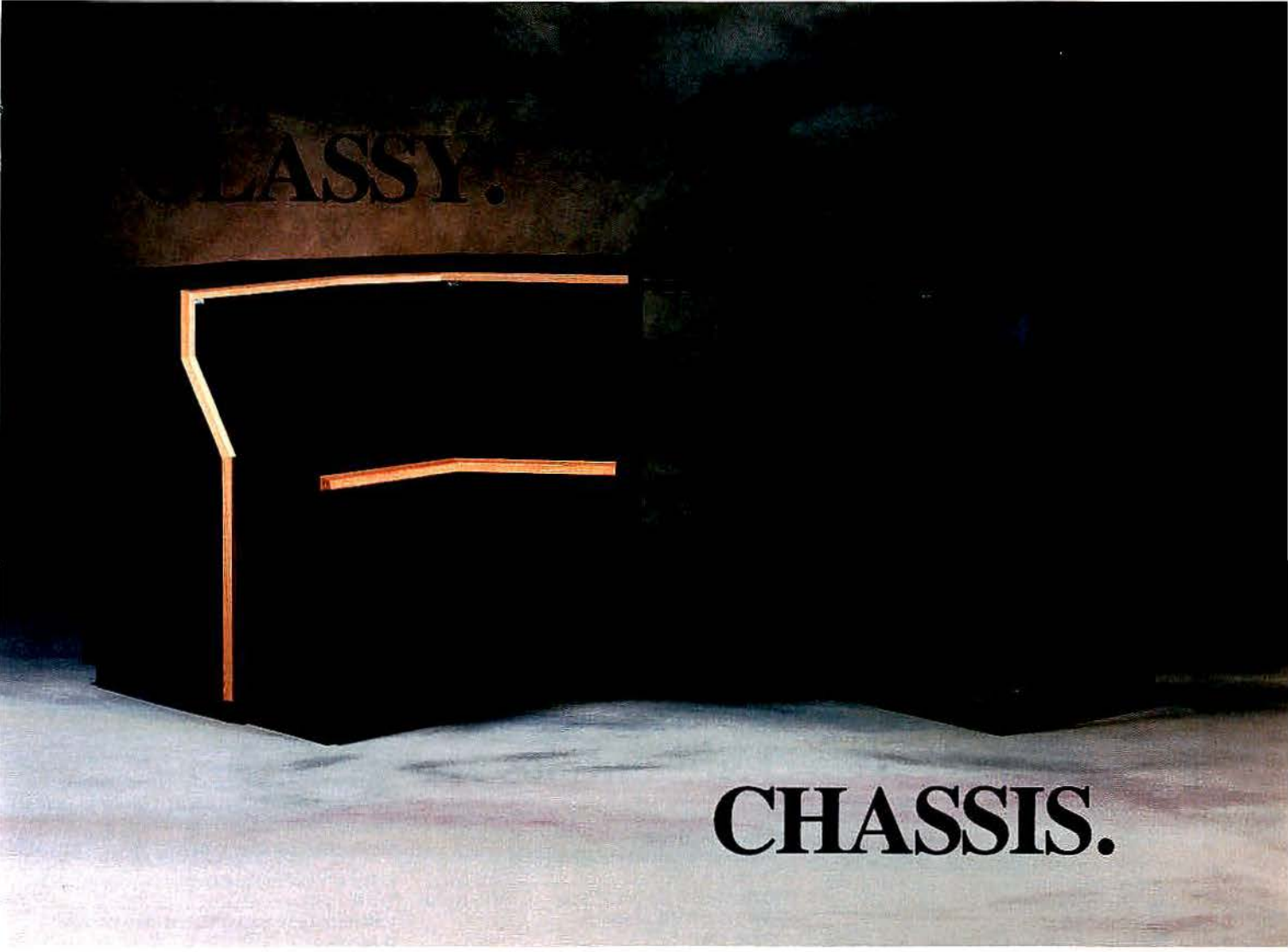
Uniden America — Booth 504
Existing products
800MHz and 900MHz portable, mobile, full-duplex mobile and trunked repeater system products; conventional lowband, VHF and UHF radio products.
New products
SMS301TSD and SMS316TSD full-duplex trunked SMR mobile radios; SPH-580E and SPH-480E VHF and UHF small synthesized portable radios.
Circle 459

See *MRT* at IMCE booths 1035, 1036.

Unipage — Booth 1120
Existing products
M15; M80; alpha transcription; Message Manager; Protege.
New products
FAXpage; TI interface.
Circle 460 — See ad page 35

Unitech Industries — Booths 1419, 1421
Existing products
Cellular accessories for hand-held, portable and cellular phones including batteries, extended life batteries, battery eliminators, eliminators and chargers, travel rapid chargers, vehicle kits and hands-free kits.
New products
Power+ eliminator and chargers for hand-held portable phones.
Circle 461

Universal Cellular — Booth not assigned
Existing products
PagerPhone.
Circle 462



When you buy an STS custom console, you're getting premium quality at modular prices.

We begin with welded tubular steel framework for maximum strength and durability. The entire frame is protected with a tough, baked-on epoxy coating, ensuring that each furniture product will keep its good looks through years of service.

Using CAD technology, our designers create facility plans that make optimal use of available floor space. Correct ergonomics for each application are carefully considered. Finishes include top-quality laminates and hand-selected hardwood trims.

Choose from a wide range of colors for coordinating counter tops, top, rear and side panels with existing or planned decor. Hand-crafted workmanship with extra attention to detail guarantees quality in appearance and fabrication.

From single-bay consoles to elaborate control and dispatch centers, STS offers you the best value in the industry. So, before you make any furniture decisions, come to STS. Call or write today for more information.

STS®

Skaggs Telecommunications Service, Inc.
5290 South Main, Murray, Utah 84107
(801) 261-4400, Fax: (801) 261-1580
Toll Free: 800-879-1787

Circle (59) on Fast Fact Card

Valmont Industries **Booths 250, 252**
Existing products
Tapered, tubular monopoles for UHF, VHF and microwave to 250' free-standing lattice to 400' and guyed towers to 800'.
Circle 463

VCP International Booths 1542, 1544
Existing products
Panasonic numeric pagers; Uniden alphanumeric pagers; Shinwa tone voice pagers; CSI Page One in-house paging system.
New products
Exide power plus UPS system.
Circle 464 See ad pages 82, 83

Vega Booths 1006, 1008
Existing products
C-5110 10-line, four-frequency tone format radio control console; 500 series tone and dc remote control consoles; 200 series tone and dc remote station adapters; C-550/RP-250 dial-up (PSTN) tone remote console and station adapter.
New products
C-5112 10-line, multifrequency modular dispatcher console offering standard production economy with the expandability of a custom design; C-1614 six-line, four-frequency desktop tone remote console for use with desk mic, footswitch and other accessories, offers separate volume controls for selected and summed receive audio.
Circle 465 See ad page 1

W&W Associates Booths 750, 851
Existing products
Replacement batteries for two-way radios, cellular phones and cordless telephones.
New products
Two-way: Kenwood PB 13, 14 and 14S; cellular: Nokia Cityman 100/190, NovAtel 825 and Mitsubishi transportable 1500 series.
Circle 466 See ad page 32A

Wacom Products **Booths 438, 440, 442**
Existing products
Coax cavity filters, duplexers, transmitter combiners and receiver multicoupler systems operative in the 30MHz-to-960MHz band; high-power ferrite isolators and loads.
Circle 467

Wavetek Booths 432, 436
Existing products
2100, 2101, 3000S and 5100S service monitors; 300 paging/trunking encoder and decoder; 2500 and 3500 cellular test sets; 400 SWR meter.
New products
2102 service monitor.
Circle 468 See ad page 55

Willmar Technical College **Booth not assigned**
Existing services
Offers a major in mobile communications technology; information will be available on the availability of two-way technicians for employment and on training problems available for prospective students.
Circle 469

Yaesu USA Booth 326
Existing products
Mobile and hand-held two-way radios featuring the Vertex series and the FTH-2070 dualband hand-held.
New products
Vertex series 99 channel mobile; FP-711 power supply for all Vertex series mobiles.
Circle 470 See ad on IBC

Zetron Booth 126
Existing products
DTMF microphones; interconnect products; software products; repeater controllers; trunking remotes; trunking repeater controllers; paging encoders; paging terminals; paging accessories; large communications systems; message recorders; remote control and alarm monitoring; radio console systems.
New products
4001 unicom console; model 72 extend-a-line; Radius-compatible products; model 230 remote control product line expansion; ZMX series microphone product line expansion; model 640 TNPP.
Circle 471 See ad pages 22, 85

Late entries

American Mobile Telecommunications Association **Booth not assigned**
Existing products
SMR database reports; State of SMR report 1991/1992; SMR handbook.
Circle 476

Anchor Graphics **Booth 1010**
Existing products
Labels for pagers, two-way radios, cellular phones, bar coding and capcodes; all types of labels.
New products
Lazer label; Clean-A-Page.
Circle 477

Antenna World **Booth not assigned**
Existing products
Antennas: mobile and portable, all bands from 100MHz to 1,000MHz; marine bands as high as 1,000MHz; directional yagi antennas for 800MHz to 950MHz. Leather cases for portable phones and pagers.
Circle 478

Audiovox **Booth 626**
Existing products
CTX series II; SBC Prestige; CTX-4200; CTX-3200; CTR-2000; CTX-5000; CMT-410A; SP-85A; BC-55A; TRAN-55; TRAN-410; PT-300; PR-100.
New products
MVX-500; PR-250.
Circle 479

ChargeGuard Booth 1450
Existing products
CGIB series automatic on- and off-timer switch for two-way radios.
New products
CGIB-24N 24V model.
Circle 480 See classified ads

Computer Resources Booths 1526, 1528
Existing products
Complete computer systems for the two-way industry; billing for service, sales, SMR, paging, recurring charges and all necessary accounting functions.
New products
Service management version software.
Circle 481 See classified ads

Hewlett-Packard Booths 1257, 1259, 1261
Existing products
HP-8920A RF communications test set; HP-8591A, HP-8593A, HP-8594A and HP-8595A portable spectrum analyzers.
New products
HP-85717A CT2-CAI cellular radio personality.
Circle 482 See ad page 77

Micro-Quick Systems Booths 1101, 1103
Existing products
Protocol sales and service software; Optima 2 SMR, PCP, RCC, MSA and RSA billing software.
New products
E-XCELL telemarketing, lead tracking and proposal package.
Circle 484 See classified ads

Riser-Bond Instruments **Booth 1448**
Existing products
Model 1210 time domain reflectometer, cable fault locator; model 2901B+ digital TDR cable fault locator; model 525 cable identifier.
Circle 485

Skaggs Telecommunications Booth 1242
Existing products
Custom equipment consoles and dispatch centers.
Circle 486 See ad page 63

Tait Electronics Booth 232
Existing products
T-800 series base stations; T-700 series mobiles; T-373 aviation band mobiles.
New products
T-802 remote site monitor.
Circle 487 See ad page 69

Telemobile **Booth 826**
Existing products
Phonelink point-to-point, Phonelink point-to-mobile, System 35 shared radio telephone and MRRT multi-access rural radiotelephone terminal and other communications radio and radiotelephone equipment.
New products
Phonelink systems with computer controlled interconnect devices; radio call box systems.
Circle 488

Western Multiplex **Booth 1256**
Existing products
Microwave radio and analog baseband equipment: 2GHz, 2.5GHz and 6GHz, 12- to 780-channel capacity radios; group and supergroup DTL converters, amplifiers, filters and accessories.
New products
Microwave Lynx TI digital microwave radio with spread spectrum to provide unlicensed operation for "instant links" and disaster recovery; requires no FCC license or frequency coordination and operates under Part 15.247 of FCC rules in 2.5GHz band.
Circle 489



Family Values

Quality, Affordability, Dependability

The technology changes every day. But in the Land Mobile Industry, one thing that has never changed is Standard Communications' commitment to the values that has made it a global force in the marketplace.

In the 1990's, Standard Communications has built a corporate relationship that stands alone. The best of American, Asian and European technology, product design, manufacturing and marketing, created through manufacturing partnerships with worldwide electronics giants Marantz of Japan and N.V. Philips, Europe's largest electronics manufacturer.



Only Standard has this unmatched global capability for innovation and product development, which had led us to a complete line of land mobile communications products that represent true value.

For more information on our family of mobile radios, portables, repeaters, and accessories, or for information on how to become a Standard dealer, call us toll free.

Standard Communications

SCC Standard Communications, Land Mobile Division, 4876 West North Temple Drive, Salt Lake City, UT 84116 800/767-6695 (FAX 801/359-4122)

Circle (60) on Fast Fact Card

Computers making inroads in land mobile

Computers and radio are merging into the same communications realm as more users require data capabilities. Speaking on the coined-phrase "ComputeRadio" at IMCE/Fall in Orlando, FL, Sept. 19-21, panelists said they foresee a viable and thriving market in the integration of mobile data and computer technologies.

"There is a spectrum of users out there who will become mobile data users," said Robert Hillman, president of Coded Communications, Carlsbad, CA. "There is a tremendous momentum building up for radio."

Why use data? There are numerous reasons why users will opt for mobile data, Hillman said. These include improved productivity, radio channel efficiency, real-time response and cost reduction.

Mobile data poses some challenges in its use because rapid fluctuations in data signal and fading are inherent in radio, he said.

"Mobile data computers and automatic vehicle location (AVL) are driving the industry," he said. "Smart adaptive modems will be required to meet the higher throughput demands generated by mobile data, computers and AVL."

The ComputeRadio technology opportunities include existing voice customers and SMR, according to John D. Abbey, president of Abbey Group, Grass Valley, CA. "Since 1986, three worlds have been coming together to form ComputeRadio," Abbey said. These include field information needs, communications and computing.

Laptops are popular with today's market, and Abbey sees a trend toward "dashtop" computing. Future enhancements will include Pen-based technology—hand writing recognition technologies, he said. Integration of ancillary systems also will transpire, he said.



Abbey: 'Since 1986, three worlds have been coming together to form ComputeRadio.'

The key to success of ComputeRadio is its *software* and *applications*, Abbey said.

For land mobile industry companies to compete in the computer and radio field, they need "to stay on the leading edge of the computer industry," according to Bill Frezza, director of strategic sales for Ericsson GE, Paramus, NJ. Otherwise, land mobile firms will lose market share

SECURICOR
PMR SYSTEMS

A wholly owned subsidiary in the Securicor Group of Companies, which is listed on the London Stock Exchange.

Source 220-222 MHz products

- **Multi-channel trunking with digital signalling (MPT 1327)**
- **Fully automatic networking of up to 16 sites per region**
- **State-of-the-art digital signal processing for stable performance**
- **Reliable, proven mobile technology for optimum use of 5kHz channels**
- **Manufactured to independently checked Quality Assurance standards (BS 5750)**

Further details: Mike Bayly, Sales Director,
Securicor PMR Systems Ltd.,
Westfield Industrial Estate,
Midsomer Norton, Avon BA3 4BS

Call: International **+44 761-413174**

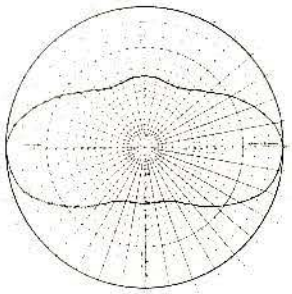
Fax: International **+44 761-418537**

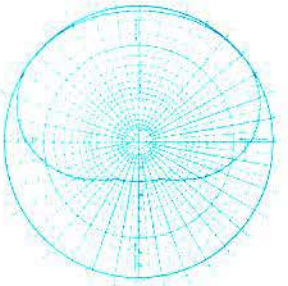
INQUIRIES INVITED FROM NETWORK OPERATORS AND ESTABLISHED DISTRIBUTORS

Circle (61) on Fast Fact Card

SCALA

Scala offers you the most complete selection of professional antennas for fixed-station applications in the 40 to 960 MHz spectrum.

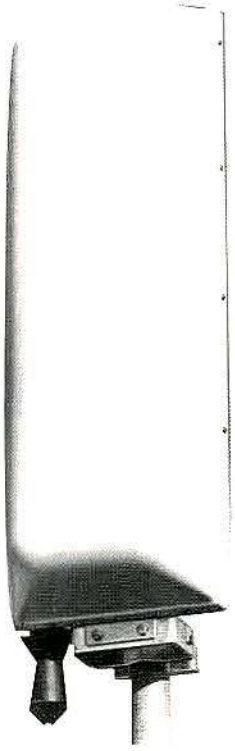


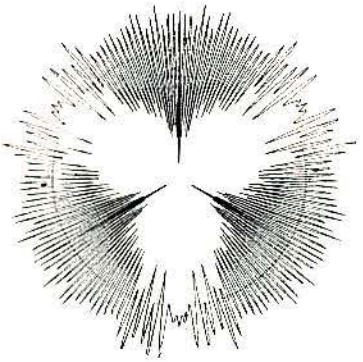


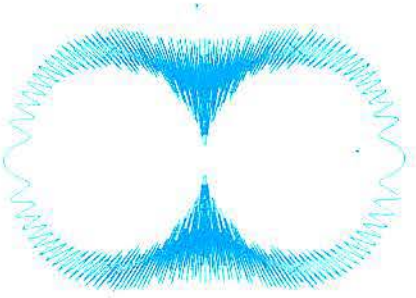


OMNIDIRECTIONAL ANTENNAS

Rugged omnis are available for every band, with special options available to optimize performance. Reliable and stable offset patterns can be achieved using Scala heavy duty reflector kits. We can advise you regarding side-mounted omnis and the pattern distortions that often result.







PANEL ANTENNAS

A broad range of panels are available for your VHF, UHF and 800/900 MHz systems. These broadband panels can be arrayed for custom patterns and gain requirements. Let us show you how we can improve multi-channel radio systems using broadband panel arrays for consistent coverage and far better performance than the typical collection of omnis planted on a building or broadfaced tower structure.

SCALA and KATHREIN antennas and arrays are available for all VHF and UHF bands. Compare the quality of construction, the record of reliability, the realistic specifications and the superb customer support and you will see why Scala and Kathrein antenna products are *preferred by professionals*.

We have the superior products and the know-how to help you enjoy the highest levels of antenna system performance. You are most welcome to contact us for complete information and assistance.

SCALA ELECTRONIC CORPORATION
Post Office Box 4580 Medford, OR 97501 (USA)
Phone: (503) 779-6500 Fax: (503) 779-3991

Circle (62) on Fast Fact Card

to computer manufacturers.

"In the not-too-distant future, the guy who buys the PC is going to be the same guy who buys the radio," Frezza said. "ComputeRadio will transform our businesses," he said.

Frezza cautioned the land mobile industry to be awake and ready for ComputeRadio. IBM already announced a computer and radio product, he said, and Apple Computer is asking the FCC for frequency for data. Hewlett-Packard has announced a 1-pound palmtop computer, model HP 95LX, that is shipping in large quantities every month, he added.

When used with Motorola's NewsStream wireless one-way receiver, the HP palmtop computer suits data needs. Paging systems can be adapted to provide wireless transmission to the Motorola receiver and the HP palmtop.

ARDIS, a joint venture between Motorola and IBM, and RAM Mobile Data's Mobitex are two packet-switched wireless metropolitan area networks delivering data today.

Advanced MobileComm files for digital radio system

Advanced MobileComm has asked the FCC for authority to install a digital radio system in New England. The Boston-based company's system will resemble "enhanced specialized mobile radio" (ESMR) systems described in applications previously filed with the commission by Fleet Call, Bloomfield, NJ.

Digital technology will increase Advanced MobileComm's current network capacity from six to 15 times. Although Fleet Call plans to convert its high-power, high-antenna sites to low-power transmitters and antennas at low elevation, Advanced MobileComm's network will use its existing sites, at least initially. The added capacity can be used to provide services such as facsimile, voice mail, electronic mail, vehicle location and "follow-me" roaming, and to improve mobile telephone service.

The company has not selected a vendor to supply the digital equipment. Construction plans are indefinite, pending FCC action on the request for certain rule waivers necessary to permit the system to be configured as intended.

Enhanced Systems, TGA team up to make paging terminal

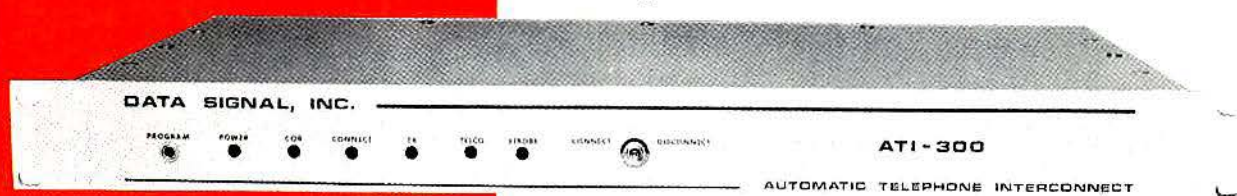
Enhanced Systems, Norcross, GA, and TGA Systems, Atlanta, have signed an agreement to develop a radiopaging terminal capable of supporting 10,000 subscribers. Under the pact, TGA developed a radio paging module for Enhanced Systems' Services Platform.

The arrangement allows TGA to sell the paging terminal, as well as Enhanced Systems. TGA's module converts Enhanced Systems' voice mail terminal to a paging terminal.

Radiopaging services with the product are being used in conjunction with BBL, Day, Glenayre, Spectrum and SkyTel paging terminals.

Feature packed, Economy priced. . .

Automatic Telephone Interconnects



Three quality interconnects, packed with all the features used most often, at prices you can afford. All are dip-switch programmable, and will operate full, half-duplex, or simplex, and come in desk-top or rack-mount enclosures. The simplex models provide digital voice delay.

CHOOSE THE MODEL THAT FITS YOUR NEEDS

The **ATI-100** has regenerated DTMF or pulse dial, direct-voice dispatch, busy channel inhibit and transorb lightning protection.

The **ATI-200** has all of the features of the ATI-100 and adds Toll-restriction, multiple digit access and is microcomputer controlled.

The **ATI-300** can be used as an interconnect, paging terminal or control station. It is completely dip-switch and keypad programmable, and all features are standard. The ATI-300 provides 35 programmable ANI-s, verified positive disconnect, 2-tone page, toll restrict per user, mobile-to-mobile, Selective call, CWID, channel monitor, DTMF or rotary overdial, voice-after page, and three programmable relays. **Priced from $249 to $595.**

DATA SIGNAL INCORPORATED

2403 Commerce Lane
Albany, Georgia 31708

Telephone: 912-883-4703
Toll Free: 800-652-9296

Circle (63) on Fast Fact Card

TAIT ... THE WAY THE WORLDS TALKING IN USE IN OVER 80 COUNTRIES TAIT ... THE WAY THE WORLDS TALKING

The Heart of a Top Performer

THE TAIT

T800

BASE STATION



Every two-way radio user is seeking better system performance, and better performance is why more and more systems operators are turning to the TAIT T800 SERIES OF BASE STATIONS and REPEATERS.

The system delivers better performance through:

- ☐ Higher specifications
- ☐ Innovative design
- ☐ Greater flexibility
- ☐ Total reliability

The TAIT T800 has been proven in some of the harshest, most demanding conditions on earth.

Talk to your nearest Tait office today about the T800 Series. Custom configurations can be designed to meet individual user requirements, including MPT 1327 TRUNKING SYSTEMS.

HEAD OFFICE
NEW ZEALAND
Tait Electronics Ltd
P.O. Box 1645, Christchurch
Phone: (64) (3) 358-3399
Fax: (64) (3) 358-3603

AUSTRALIA
Tait Electronics (Aust) Pty Ltd
Phone: (07) 266-3399
Toll Free: (008) 07-7112
Fax: (07) 266-7559

HONG KONG
Tait Electronics Ltd
Phone: (852) 517-0000
Fax: (852) 517-1818

SINGAPORE
Tait Electronics (Far East) Pty Ltd
Phone: (65) 253-5777
Fax: (65) 251-7778

USA
Tait Electronics (USA) Inc.
Phone: (713) 984-8684
Toll Free: 800 222-1255
Fax: (713) 468-6944

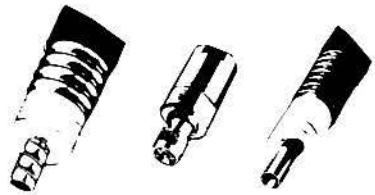
UNITED KINGDOM
Tait Mobile Radio Ltd
Phone: (0480) 52255
Fax: (0480) 411996

"Large enough to rely on and small enough to listen."

TAIT ... THE WAY THE WORLDS TALKING IN USE IN OVER 80 COUNTRIES TAIT ... THE WAY THE WORLDS TALKING

Circle (64) on Fast Fact Card

SANTA FE
distributing
FOR ALL YOUR
CELWAVE RFS
PRODUCTS



CELLFLEX® Closed cell foam dielectric with low density & high velocity
AVAILABLE IN
1/2" 7/8" 1 5/8"

LLFLEX ® Foam - stranded inner conductor, excellent flexibility, low loss
AVAILABLE IN 1/2"

SANTA FE CAN CUT TO LENGTH & INSTALL CONNECTORS
REELS or BOXES

FULL LINE OF
CELWAVE RFS
BASE ANTENNAS
MOBILE ANTENNAS
DUPLEXERS

SANTA FE distributing
800-255-6595
14400 West 97th Terrace
Lenexa, Kansas 66215
913-492-8288 Local
913-894-2136 Fax

WE CAN FILL YOUR NEEDS WHETHER LARGE OR SMALL

Circle (65) on Fast Fact Card

FCC engineers, specialists strive to resolve interference

In each FCC field office, public service specialists are the first to receive complaints, unless a safety issue that must be resolved immediately is involved. Such a complaint is referred to an engineer. Otherwise, public service specialists work on complaints until they are resolved or until they determine an engineer's assistance is required.

Kevin McKeon, a public service specialist in the FCC Field Operations Bureau's New York office, said most co-channel interference complaints are resolved by checking the database to verify who is licensed for the channel and by discussing the situation with the complainant.

If the complaint involves simply hearing others on the channel, "we tell them they have to share the channel with other licensed users," he said. "Many of the complainants say they did not realize that, and that they thought the channel was just for them."

If the complaint involves another operator interrupting someone's communication because the first operator does not monitor before transmitting, "we send a letter to both companies and direct them to get together and try to resolve the problem on their own. We get success 60% to 70% of the time," McKeon said.

Enforcement power

Judah Mansbach, an electronics engineer in the New York office, explained that although public service specialists do not have enforcement power, the FCC has delegated enforcement authority to its Field Office Bureau engineers. "We can shut down a station; direct the licensee to make technical changes to the station; and issue advisories, violation notice and fines. Together with other law enforcement agencies, such as the Federal Bureau of Investigation, U.S. Customs Service, U.S. Coast Guard and the U.S. Marshals Service, we can search for and seize radio equipment used for illegal purposes."

As an example of a station he would shut down, Mansbach said he would shut down a business or industrial land mobile station causing serious interference to a public safety land mobile station if there were no other resolution, such as an immediate technical solution. "I would shut the station down without hesitation," he said. "Safety of life and property comes first, always."

Another example of a station he would shut down is an unlicensed station. "In almost every case," Mansbach said, "I will shut an unlicensed station down. In unique cases, such as stations operating in the safety radio service, I will give the operator time to get a license, but it would be a very short time, like the rest of the afternoon or by tomorrow morning. His options are either to produce a license or a special temporary authorization—or to shut the station down." The engineer explained that continued unlicensed operation can subject the operator to penalties provided in the Communications Act. Penalties for a first conviction include a fine as high as $100,000, a prison term as long as one year or a combination.

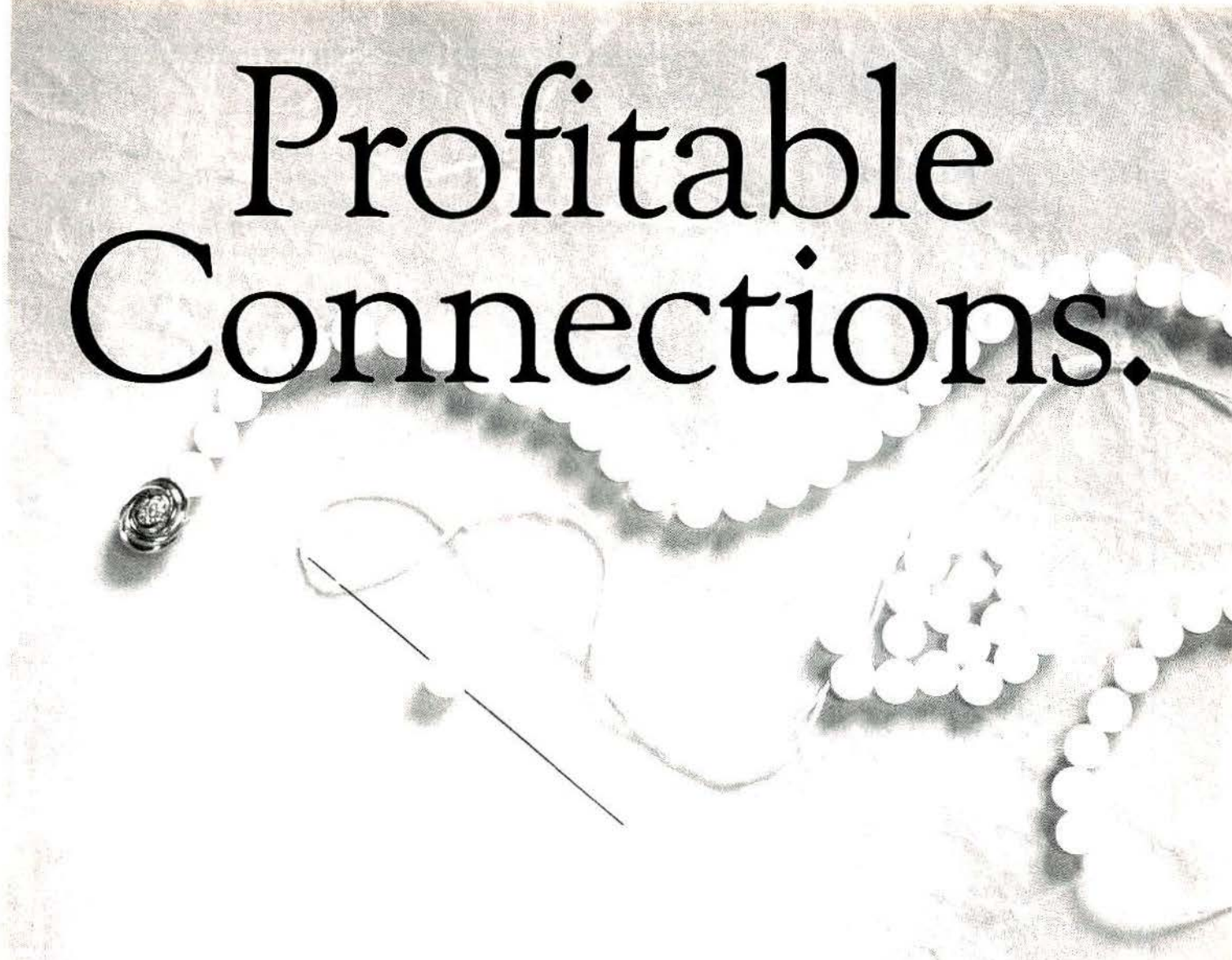
Service companies

Mansbach said he knows most of the radio communications service companies in the New York area: "Many times, Kevin McKeon and his colleagues will refer an interference complaint to me and, from looking at it, I will know which service company is likely to be involved. I'll pick up the phone, call the service company and ask, 'What customer did you just put on that frequency?' It usually turns out their newest customer is the one causing the problem, and either a call from us or from the service company resolves the case. I have an excellent working relationship with most of the service companies in our area."

McKeon said a few service companies "are less than cooperative" with the FCC and put stations on the air without licenses.

Mansbach added that some of the "good guys" among today's service companies were the "bad guys" of 20 years ago. Asked what turned them around, he said: "They made some money in the business and began to realize they can make it doing it the right way. They don't need to sell illegally imported radios or to modify radios for unlicensed use to support their business."

Profitable Connections.



LIKE SO MANY SMR OPERATORS YOU MAY BE CONSIDERING THE PROFIT POTENTIAL OF INTERCONNECT NETWORKING. Whether the distant sites involved are owned by you, or your SMR neighbor, your roaming customers may have a real need for easy interconnect accessibility.

Will you need more hardware...more phone lines...you're not sure where to begin...or who to call first.

At Hark Systems we've been helping people just like you for years. We gather all the important information on everything from phone line costs to system design. And very often, we can present you with a number of options.

So, if you're considering an Interconnect Network and you need someone to help you make all those profitable connections call on Hark Systems.

HARK

Hark Electronic Systems, Inc.
1801 Trolley Road
Summerville, SC
Fax (803) 873-5277
1-800-367-4275

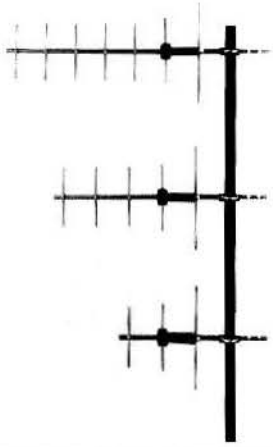
FOR MORE INFORMATION CALL 1•800•FOR•HARK

Circle (66) on Fast Fact Card

COMTELCO INDUSTRIES

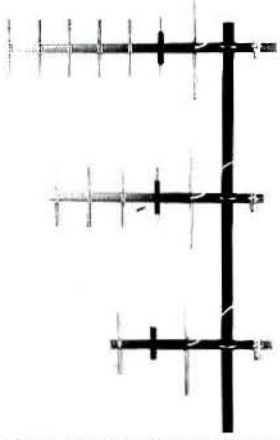
YAGI ANTENNAS
VHF/UHF

"Champion Series"
150 Watt Power Rating
UV Polyester Coated



"TNC" TERMINATION
3 Element 6dB $25.00
5 Element 9dB $30.00
7 Element 12dB $35.00

"Heavyweight Champion Series"
300 Watt Power Rating
UV Polyester Coated



PIGTAIL "N" TERMINATION
3 Element 6dB $30.00
5 Element 9dB $38.00
7 Element 12dB $43.00

Call For Free Product Data Book

1-800-634-4622
Quality Products Made in the USA since 1978
Comtelco Industries, Inc.
501 Mitchell Rd., Glendale Hts., Illinois 60139

Circle (67) on Fast Fact Card

Regulating technology

He said one such category of equipment includes AM transceivers sometimes combined with RF power amplifiers operating at 27.405MHz-to-27.995MHz frequencies between the CB band and the amateur 10-meter band, and below 26.965MHz, the lower edge of the CB band.

Such equipment has been popular with illegal car services, including unlicensed taxicabs and limousines. McKeon said what brings the illegal equipment to his attention many times are TV interference complaints. "The car services open up in a residential area in a store front. In New York, people live around these store fronts. When the base station uses an amplifier, it is likely to interfere with TV reception and telephone communication, and we hear about it," he said.

Another source of complaints is the Taxi and Limousine Commission. "Aside from their radio operations, the way the unlicensed car services operate their businesses can cause problems to the communities," McKeon said.

NABER asks FCC to extend SMR loading deadlines

The National Association of Business and Educational Radio (NABER) has asked the FCC to extend deadlines for loading 900MHz specialized mobile radio (SMR) systems in the top eight designated filing areas (DFAs).

System operators outside the top three markets are having difficulty loading their systems to the present minimum of 70 mobiles per channel within five years after licensing. NABER has requested the government to change the minimum to 14 mobiles per channel at five years after licensing and 70 mobiles per channel at seven years.

The CTI Advantage
For Changing Times and Changing Customer Needs

Introducing "NEW" Products by CTI
When: February 18, 19, 20
Where: IMCE – Las Vegas
Booth 746
Watch For Details!

CTI Inc.
P. O. BOX 780 — CORINTH, MISSISSIPPI 38834
TELEPHONE (601) 287-8081
FAX 601-287-9427 — SALES 800-752-3646

Circle (68) on Fast Fact Card



MAGELLAN 5-CHANNEL GPS TECHNOLOGY.

A universe of applications at a down-to-earth price.

The Global Positioning System (GPS), the most accurate, worldwide navigation and positioning system available, is more accessible than ever. Magellan announces a highly affordable, five discrete channel OEM GPS receiver module to meet all your GPS integration needs. Five continuous tracking channels provide:

• Uninterrupted one-second position updates • Superior tracking in high-dynamic environments and areas of obstructed satellite visibility • No degradation in RF sensitivity (unlike multiplexed receivers).

Magellan's five-channel OEM receiver module is still the most affordable on the market, and is plug-, form- and software-compatible with its single-channel OEM module.

The use of Magellan's exclusive gallium arsenide/MMIC technology and digital signal processing allows this C/A code module to easily accommodate a vast array of applications, including: • *vehicle tracking* • *avionics* • *military* • *vehicle navigation* • *marine* • *scientific.*

Custom-tailored to your needs.

To help you move into these rapidly expanding markets, Magellan offers the added flexibility of customized hardware and software configurations to meet your specific needs.

Leading the field in advanced GPS technology, Magellan components have been integrated into a wide variety of applications for customers in diverse markets throughout the world, and have proven to be exceptional in quality and reliability. Whatever your GPS application, look to Magellan for low-cost, high-technology solutions.

MAGELLAN
WE BRING GPS DOWN TO EARTH™

For more information, please contact: Magellan Systems Corporation, 960 Overland Ct. San Dimas, CA 91773.
Phone: (714) 394-5000 FAX: (714) 394-7050. Magellan™ is a trademark of Magellan Systems Corporation.

Circle (69) on Fast Fact Card

TOP CHOICE



DATARADIO MRM
The most widely used Mobile Radio Modem

The performance of your mobile data system depends on the radio modem you specify. Whether your fleet is a few cars or a few hundred, you need an experienced supplier with a proven product. Dataradio's ten years of supplying radio modems and support services have made us the industry leader. Over a million hours of field use have made our Vehicular Information Series (VIS) the choice of mobile data users, CAD vendors, systems houses and OEMs. Dataradio VIS modems meet your requirements at a very affordable and competitive price. Compare these features:

- 1200, 2400, & 4800 bps
- Trunking or Conventional
- Universal Radio & Data Interfaces
- Designed For Mobile Environment
- Error Detection & Correction
- ASIC Multi-mode Modem
- Laptop PC compatible
- Wide Area System Capability

Whether adding data to an existing mobile network or implementing a new system, ask for us by name, or call us with questions you may have. Dataradio. We're always at your service.

DATARADIO
The source for radio datalinking technology

Telephone: (404) 392-0002
Fax: (404) 392-9199
In Canada:
Telephone: (514) 737-0020
Fax: (514) 737-7883
Telex: 058-25538

Circle (70) on Fast Fact Card

ACT update

'Tech-of-The Year' nominations continue to arrive

By Thomas Green

The National Association of Business and Educational Radio (NABER), of which the Association of Communications Technicians (ACT) is a membership section, will present its first "Tech-of-The-Year" award in May 1992. This award recognizes the role technicians play in the industry and honors the technician who has shown an outstanding effort in the performance of duties. The winner will receive an all-expense-paid trip to the May 1992 NABER Annual Mobile Conference in Washington, DC, and an inscribed plaque presented by NABER's board chairman. Nominating forms are available from the association at 800-759-0300.

Unlicensed operation

During 1991, NABER has been studying unlicensed radio communications equipment operations and soliciting input from unlicensed operations and government affairs task force members, directors, council members, the general membership and other individuals within the private land mobile industry.



Thomas Green

In February 1991, the association launched an all-out effort to attack the problem of unlicensed operations. Using information provided by those affected on a daily basis by unlicensed operations, and with the suggestions provided by its membership, NABER developed 10 proposals to curb unlicensed operations. It surveyed members and non-members to obtain reactions to those proposals.

Survey results include:

1. To require product labeling that explains the licensing laws and include a license form within the product's packaging: 59% support and 41% oppose.
2. To file license applications electronically with the frequency coordinator: 73% support and 27% oppose.
3. To simplify FCC Form 574: 77% support and 23% oppose.
4. To give warranties on radios only upon documentation of license: 26% support and 74% oppose.
5. To develop a special form for filing complaints to alert the FCC of an unlicensed operation that should be investigated: 79% support and 21% oppose.
6. To develop an educational campaign to explain why licensing is important to spectrum management: 61% support and 39% oppose.
7. To increase fines and sanctions: 66% support and 34% oppose.
8. To levy a tax on radios that would be earmarked for enforcement: 9% support and 91% oppose.
9. To place the legal responsibility for licensing with the dealer instead of the user: 18% support and 82% oppose.
10. For the FCC to require technician certification: 46% support and 54% oppose.

NABER is developing anti-unlicensed operations initiatives to bring before Capitol Hill and the FCC. Look for information on these initiatives in future ACT Update columns.

Green is the ACT leadership council chairman and a communication electronics instructor at Ranken Technical College, St. Louis.

Information

For information about ACT and technician certification, call 800-759-0300. Ask for 'technician services.'

Technician certification examinations will be offered at 120 sites in 43 states on the following schedule:

TEST DATES	REGISTRATION DEADLINE
Feb. 21 and 22	Jan. 24
May 1 and 2	April 6
Sept. 18 and 19	Aug. 24
Nov. 6 and 7	Oct. 12

BREAKING UP IS HARD TO DO.



Larsen Antennas Come Through Loud And Clear.

Those whose lives and livelihood depend on clear communication, depend on Larsen antennas. Law enforcement officers. Fire fighters. Construction crews. Oil explorers. The list is endless. So are the advantages.

Larsen antennas communicate further and more efficiently. Our exclusive Kūlrod® stainless steel whips turn maximum power into clear communication, not resistance heating. The whip increases flexibility and minimizes radiation pattern distortion. The result is a clear, constant signal.

More than 25 years of industry leadership go into every one of our products. Over 800 in all. Each with a specific use. And all backed by our No Nonsense one year warranty.

In the U.S.A., call 1-800-426-1656 or 206-944-7551.
In Canada, call 1-800-663-6734 or 604-872-8517.
It'll be the beginning of a beautiful and profitable relationship.

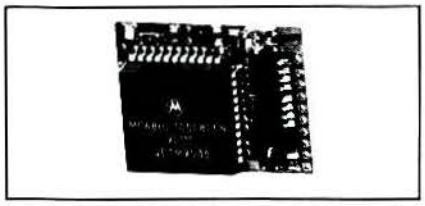
Larsen® Antennas

Larsen® and Kūlrod® are registered trademarks of Larsen Electronics, Inc., U.S.A.

Circle (71) on Fast Fact Card

Miniature ANI module permits programmability

The ANI-U miniature and programmable ANI module from **Midian Electronics** is available with a 51-code CTCSS encoder option. The ANI unit boasts programmability of formats, timing and features. The unit can send leading or trailing ANI, as well as emergency ANI.



Circle (290) on Fast Fact Card

Headset with built-in mic works with portables



The Voxset headset with no visible mic from **Earmark** attaches to the speaker-mic connector on a portable radio for Vox operation. The headset suits high noise areas, and the headset is powered by its own 9V battery.

Circle (498) on Fast Fact Card

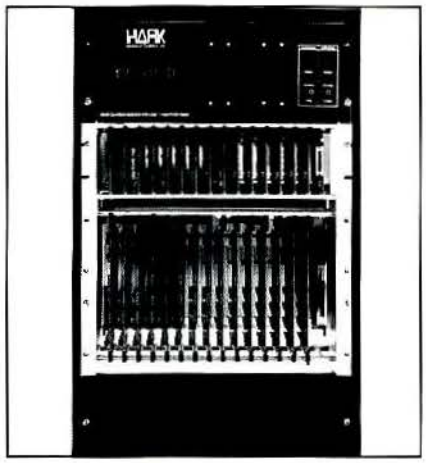
Service management software uses PC mouse support

Version 3.0 service management software from **Pyramid Communications** incorporates mouse support, data entry screens, duplicate data checking and auto backup. The software includes multiple forms, mailing labels and history archiving, in addition to inventory management functions.

Circle (499) on Fast Fact Card

Interconnect switch suits network subscriber needs

The Network Call Distributor from **Hark Systems** serves as the switch for Mobile ComNet's network. The switch maintains network subscribers positions as subscribers update the switch while traveling. The distributor serves as an interconnect link, routing calls to the system of choice, and unanswered calls are rerouted to voice mail.



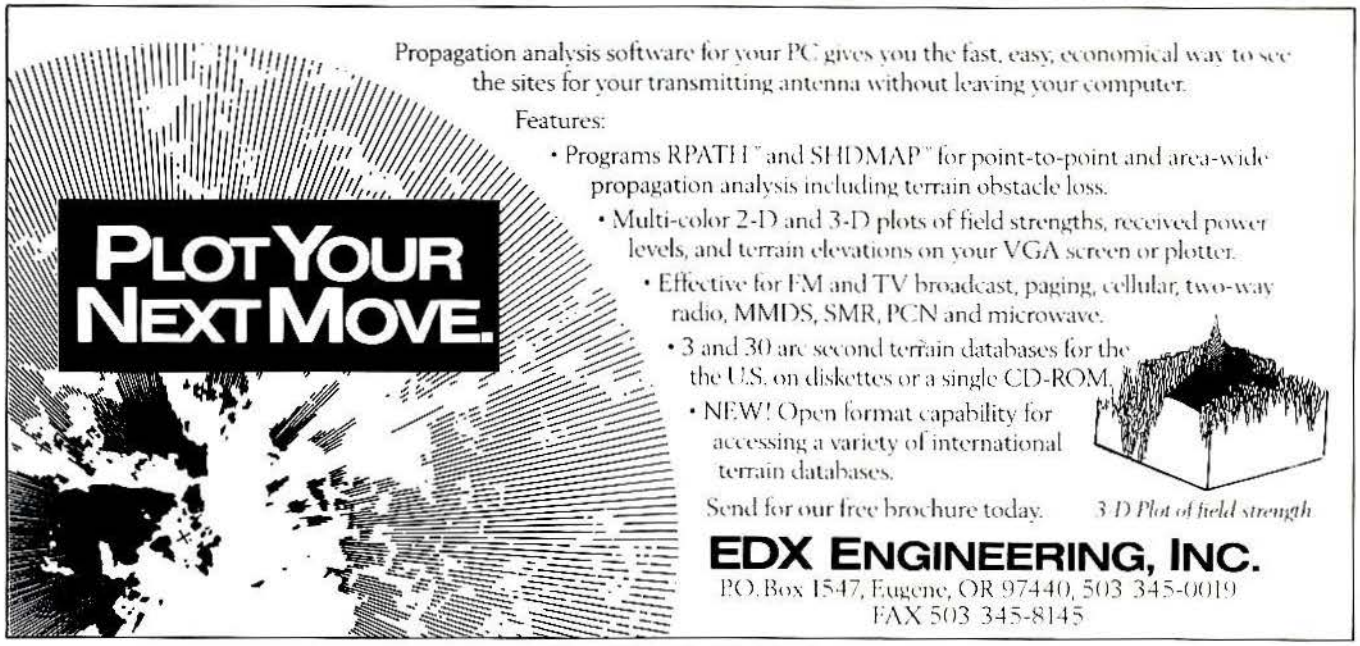
Circle (500) on Fast Fact Card

UHF transceiver offers 4 channels, 5W output

The EasyTalk UHF-50 hand-held features 5W output and four channels. The **Nady Systems** transceiver offers selectable power output of 1W or 5W. Transmitting range is as far as 5 miles. The radio comes with a rubber duck antenna with a BNC connector, an ac-dc wall charger, belt clip, carrying case and an 11V NiCd rechargeable battery pack.

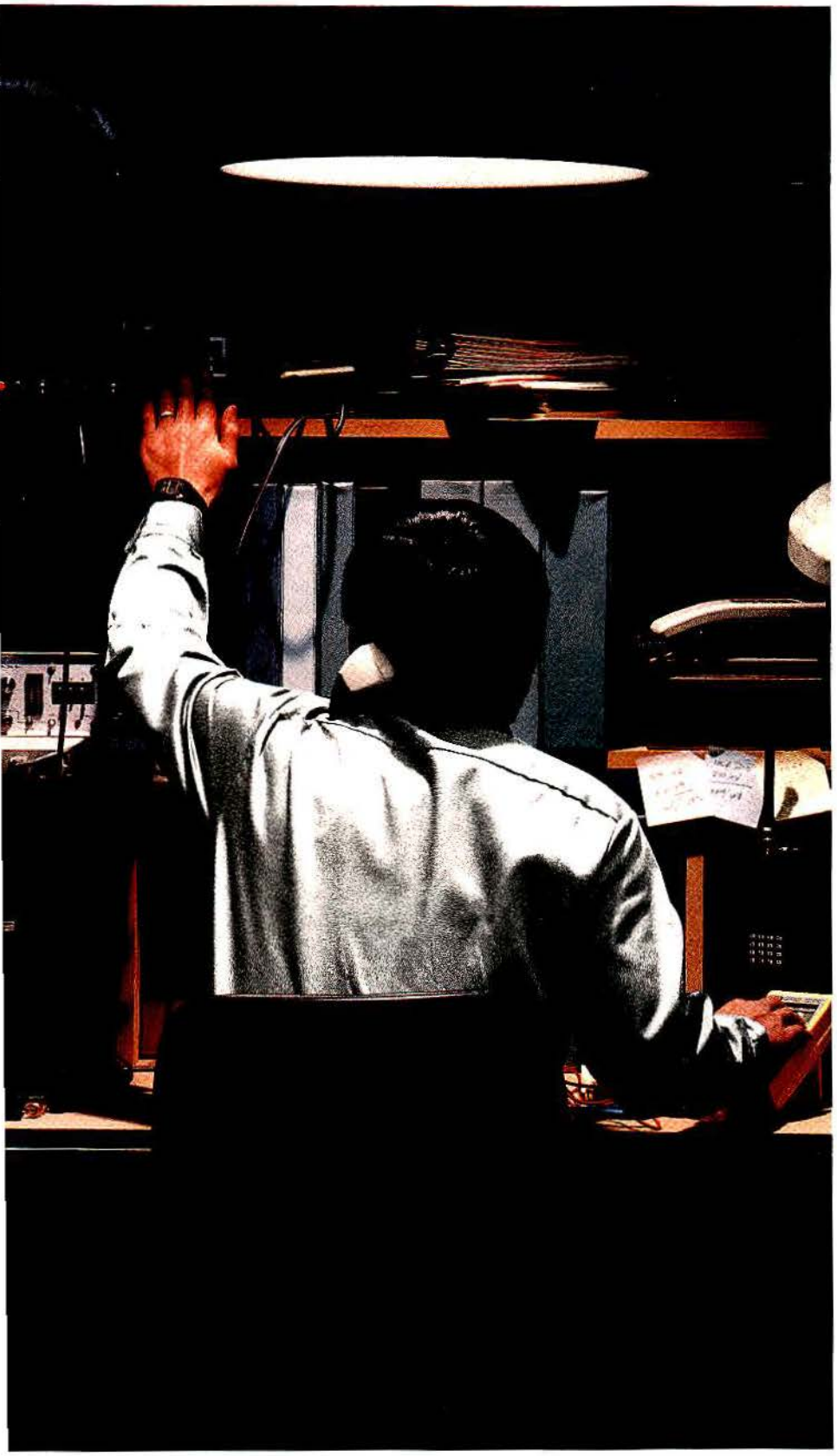


Circle (501) on Fast Fact Card



Circle (72) on Fast Fact Card

When we talked to technicians about service monitors, they told us they were too busy to talk.



Now, the new HP 8920A solves test problems in less time, so you have more.



In radio testing, you have to work fast to keep up. And when it comes to working fast, the new HP 8920A RF Communications Test Set can put you way ahead. For just $13,800.*

It's ready to go when you are. Just connect your AM, FM, SSB or cellular radio to the HP 8920A to get receiver results. Push the TX key to automatically tune and measure transmitter frequency, power, deviation and audio power. Push another key for full duplex measurements.

And it goes wherever you need it. At only 35 pounds, the HP 8920A has all the precision troubleshooting tools you need in the shop or field. That includes an oscilloscope, duplex signal generator, AC/DC voltmeter and optional signaling encoder/decoder. You can add a spectrum analyzer with built-in tracking generator and RF probe to make short work of hard problems. And a built-in controller lets you automate routine tasks.

So, if test problems are tying you up, talk to HP. Call **1-800-752-0900,** and ask for **Ext. 2149.** We'll send you a free video that shows how fast the HP 8920A can give you more time.

There is a better way.

HEWLETT PACKARD

*U.S. Price only.

©1991 Hewlett-Packard Co. TMSPK301A/MRT

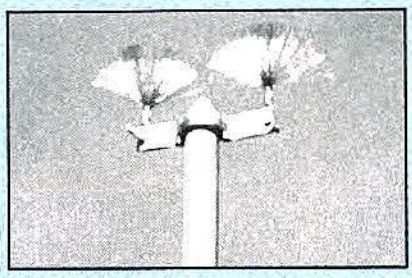
Readers' choice

Of all the new products and services in the May 1991 issue, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

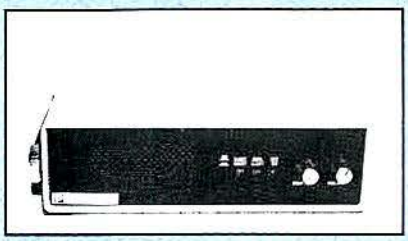
Static dissipator set mounts to dc-grounded antennas

The static dissipator set from **Lightning Master** mounts on top of any dc-grounded antenna. The set includes two LMC PP-1S dissipators and an HC-48-A2 clamp and weighs about 8 ounces. The set can be used on omnidirectional and directional antennas.

Circle (515) on Fast Fact Card



Alert monitor receiver accepts multiple formats

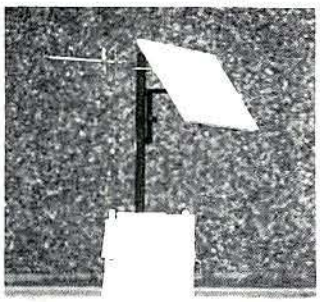


Model R8000 fixed alerting monitor receiver operates on 110Vdc, 12Vdc or internal batteries. The **Falkner & Associates** receiver handles most signaling formats, including two-tone sequential, Plectron digital, CTCSS and DTMF.

Circle (513) on Fast Fact Card

HUTTON SOLAR POWER SUPPLIES

Feature SIEMENS SOLAR INDUSTRIES Modules for efficiency, reliability and quality.



Hutton selected the Siemens Solar Industries 'M' series solar electric power modules to power the Hutton Solar Power Supplies because of their high conversion efficiency, their rugged construction, high reliability and 10 year warranty on power output.

Hutton Solar Power Supplies provide electric power in 12 or 24 Volts to SCADA and Telemetry systems using from 10 Watt-hrs to 1000 Watt-hrs per day. Whether the application is a temporary monitoring of conditions at a site or a permanent power supply for a data gathering and radio telemetry system or a communications repeater, there is an HSP series supply for you. Compare the construction costs for a utility run plus the monthly minimum meter charge with the cost of a Hutton Solar Power Supply and you will see why solar has become the alternate power source for today.

Call the Solar Power Sales Team today for more information on how we can solve your remote power problems.

HUTTON

Hutton Communications
4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811

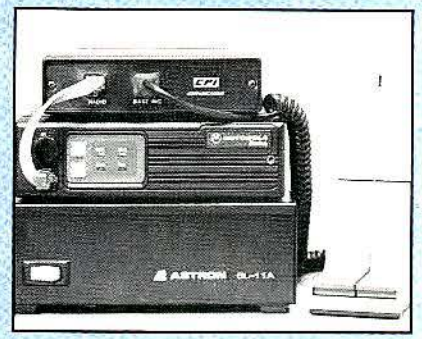
Hutton Communications
5600 Oakbrook Pkwy.#280
Norcross, GA 30093
404-729-9413
FAX 729-9567
800-741-3811

Hutton has what it takes!

Circle (75) on Fast Fact Card

Termination panels offer modular plug connections

The MR series termination panels provide a simple interface of dc and tone remote controls to various Motorola conventional and trunking mobiles. The **CPI Communications** panels feature simple modular plug connections; remote or local operation or both; separate Tx and Rx audio amplification; and monitor functions.



Circle (514) on Fast Fact Card

4W mobile radio boasts PC programmability

The MDS mobile radio includes 4W audio output and PC programmability. The **Ericsson GE Mobile Communications** trunked unit features 10 areas and 10 groups capability; good audio quality; and a compact size.

Circle (292) on Fast Fact Card

Radiotelephone interfaces carry lower price tags

Three configurations of the **Selectone** ST-40 Hyperdyne radiotelephone interface offer lower prices and include:

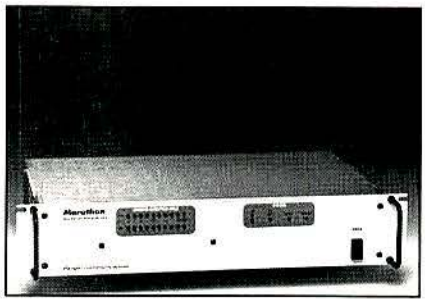
☐ ST-40DTMF with a factory-installed DTMF decoder for telephone ringing via DTMF signaling.

☐ ST-40Page includes a paging encoder for DTMF or two-tone sequential paging from any office telephone.

☐ ST-40LTR includes a logic trunked radio remote channel select board to allow system and group codes from any office telephone.

Circle (294) on Fast Fact Card

Synthesized repeaters house Tx, Rx deviation meters



The Marathon line of synthesized repeaters suits base station, community repeater, control, leased-line elimination, point-to-point communication or full duplex links applications. The **Ranger Communications** repeater includes thermostatically controlled cooling fan; 110Vac, 220Vac power supply; continuous duty cycle; variable power output; modular construction; multifunction interface; and Tx and Rx deviation meters.

Circle (502) on Fast Fact Card

Hutton has what it takes!

Larsen Antennas · Siemens Solar Industries · Gatesair-Johnson · ASTRON CORPORATION · ANDREW · CENTURION · Multiplier · PANAVISE · ANTENNA SPECIALISTS · BIRD · CELWAVE · ifr · RF INDUSTRIES LTD · cushcraft/Signals · QUANTUM BATTERIES · DECIBEL · ROHN · SHURE · MAXRAD State of the Art Antennas

ALSO AMPHENOL, API, ASTRON, AUBURN TECHNOLOGY, B&K, BAND-IT, BECKMAN, BELDEN, SUN SELECTOR CABLEWAVE, CPI, COMMUNICATIONS SPECIALISTS COOPER TOOLS, DYNASTY, FLUKE, HELIOTROPE GENERAL, HELPER INSTRUMENTS, HUSTLER INNOVATIVE MANUFACTURING, JABRO, JOHNSON CONTROLS, KENWOOD,METRO TEL, MOBILE MARK, MOTOROLA/RADIUS/R-NET, NEWMAR, OPTOELECTONICS, PACE, PALADIN, POLYPHASER, POWERSONIC, RITRON, SAT-PAK, SCALA, SCI, SCIENTIFIC DIMENSIONS,SIMPSON, SINCLAIR, SELECTONE, SOLID STATE COMMUNICATIONS, SONNENSCHEIN, SPECO, STANDARD COMMUNICATIONS, STATPOWER, TPL COMMUNICATION, UNITECH, & ZOMEWORKS

*some lines may not be available at all warehouses

HUTTON

Hutton Communications
4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811

Hutton Communications
5600 Oakbrook Pkwy.#280
Norcross, GA 30093
404-729-9413
FAX 729-9567
800-741-3811

Hutton National
9810 FM1960, Ste 215
Humble, TX , 77338
713-446-4050
FAX 446-5579
800-325-8950

Circle (76) on Fast Fact Card

MARK THIS PAGE...

If Your Communication system requires:

-Wide bandwidth in one radio
-Up to 99 channels available
-MIL SPEC 810 CD approved
-CTCSS tones
-Dealer Programmable radio
-Technical Support
-Clonable
-Custom Software available
-DTMF w/ANI mic
-Trunk mount

Then Contact:

TAD RADIO

(509)326-1511

FAX (509)326-1430

"for further information"

Models Available:

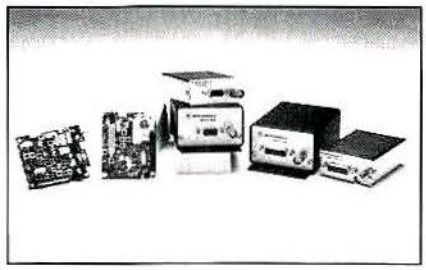
M8-VHF MD150-VHF
M8-UHF MD450-UHF

In Canada PH(604)545-1150

Circle (77) on Fast Fact Card

New products

Radio modem operates at user-selectable data rates

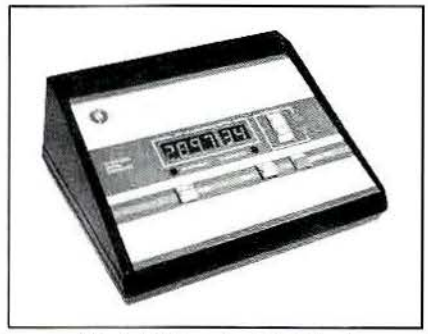


The RNet 9600 radio modem from **Motorola Radius Division** operates at user-selectable data rates of 9,600bps, 4,800bps, 2,400bps or 1,200bps. The modem comes in UHF at 403MHz-to-430MHz range and 450MHz-to-470MHz range. The modem comes with 2W or 4W output power.

Circle (503) on Fast Fact Card

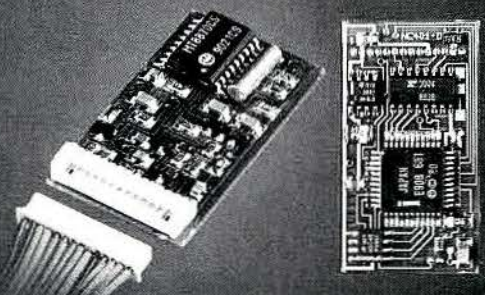
Digital controllers store 10 ANIs, 5 emergencies

Model TR3200 and model TR3210 digital ANI display controllers work with **Transcrypt's** FlashCall digital signaling modules. The units store 10 ANIs and five emergencies. Features are field programmable. The TR3200 decodes and displays unit ID and status and provides responding emergency. The TR3210 controls model SC2460 base station and includes a scrambled message indicator, scrambler on and off control, and scrambler code selector.



Circle (504) on Fast Fact Card

BORN AGAIN.



MODEL NC401 DTMF DECODER

AVAILABLE NOW the NC401 combines two distinct separately addressable DTMF Decoders in one highly versatile unit, offering multiple user configurable output functions through microcontroller technology and NorComm's custom software. Decoding all 16 standard DTMF characters, 1 to 14 digits and non-volatile storage of programmed codes, input/output functions, deadbeat disable and user outputs.

Call or write today for pricing and full specifications.

NORCOMM™ TONE SIGNALLING PRODUCTS

TOLL FREE SALES 800-874-8663 • FAX (916) 477-8403
12438 Loma Rica Drive "A", Grass Valley, CA 95945

Circle (78) on Fast Fact Card

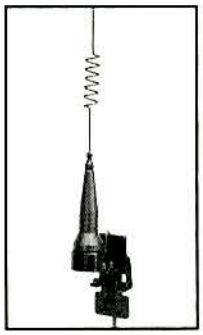
Dial click converter works with paging, SMR systems

The NB-34 dial click converter counts rotary dial clicks or DTMF tones and processes them for output as DTMF tones or DID pulses. The **CTI** unit works with paging terminals, SMR systems, voice mail systems and other equipment.

Circle (505) on Fast Fact Card

Clip-on antenna serves temporary-mount uses

The CMX3989 temporary-mount cellular antenna clips on to a vehicle's window and offers 3dB gain, low SWR and wide bandwidth. The antenna is available from **Ora Electronics**.



Circle (495) on Fast Fact Card

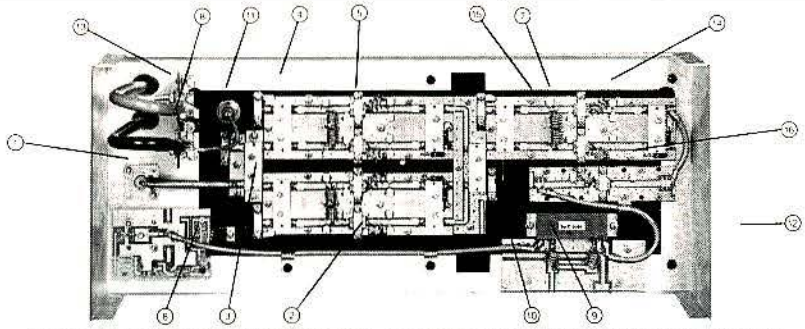
Vehicular repeater supports 96 channels



Model EAR2001-CXB crossband vehicular repeater supports communications between two separate **Fujitsu Ten** Citadel VHF and UHF user groups. The repeater accommodates 96 channels per band and comes with a portable carrying case. Six-channel models are available.

Circle (275) on Fast Fact Card

16 REASONS TO BUY OUR RF AMPLIFIERS



A bad amp can be your worst nightmare. Ask us what we've been doing over the past 11 years to make your dreams come true. Our Catalog details 16 important technical points you should know before you make a commitment to an RF amplifier supplier. Our product line includes:

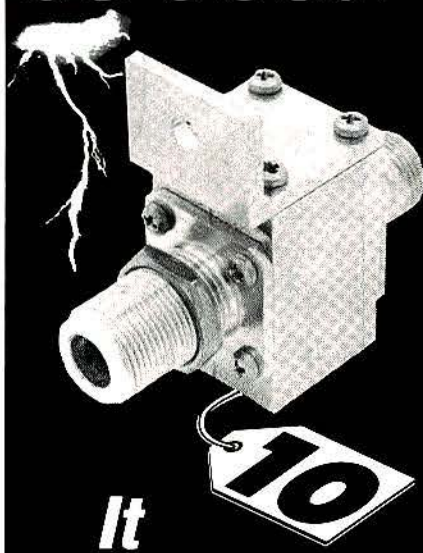
- VHF Low Band to 400 watts
- VHF High Band (140-200 MHz) to 300 watts
- UHF Low Band (400-550 MHz) to 400 watts
- UHF High Band (800-960 MHz) to 150 watts
- True continuous rating at high ambient temperatures
- "Bullet-Proof" heavy duty protected amplifiers for mobile and simplex applications

VoCom/RF Corporation
Quality since 1979

1/800-872-6233
Call 1-800-USA-MADE
In Illinois 708/885-3296

Circle (74) on Fast Fact Card

Works So Good



It Rates A 10

Now with our Mil-S-45208A quality assurance system, we are providing a solid 10 year warranty.

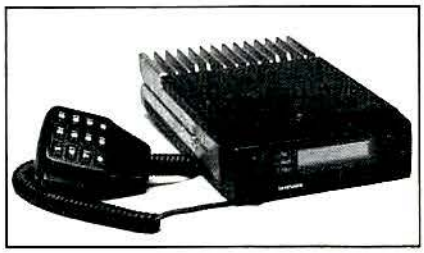
Nothing works as well at protecting your equipment investment as an original patented PolyPhaser.®

1500 models of coax, power and twisted pair protectors ... plus lightning/EMP and grounding solutions.

PolyPhaser CORPORATION
2225 Park Place
P.O. Box 9000
Minden, NV 89423-9000
(702) 782-2511 • (800) 325-7170
FAX: (702) 782-4476

Circle (79) on Fast Fact Card

Trunked mobile radio serves 30 systems



The SC9830 trunked mobile radio includes 30 systems and 11 groups per system. The **Shinwa** radio features alphanumeric LCD, programming through the mic jack and 30W output power. The radio offers three scanning functions: group, system and region.

Circle (506) on Fast Fact Card

GO BEYOND EXTENDED LOCAL CONTROL, WITH LTR® REMOTES



TRUE TWO WIRE REMOTE CONTROL FOR YOUR LTR®SYSTEM

The CPI TSR Series Remotes give you TOTAL control of your E.F. Johnson 8600 - series trunked radio over a single two wire voice grade pair. No more distance limitations or multiconductor installations. CPI's TSR remotes give you up to 75 remote dispatch points that can be in house, across town, or across the country, each displaying the LTR® control stations selected system and group as well as scan enable/disable function, aux. function, led indicators for call, aux, and PTT, and intercom capability between parallel remotes. So why buy a LIMITED multiconductor extended local when you can have an UNLIMITED two wire remote? LTR is a registered trade mark of the E.F. Johnson Co.

CPI *Bringing you the CUTTING edge... **FIRST !***

1186 COMMERCE DR. RICHARDSON, TX 75081 1(214)437-5320 1(800)869-9128

Circle (81) on Fast Fact Card

NUMERIC



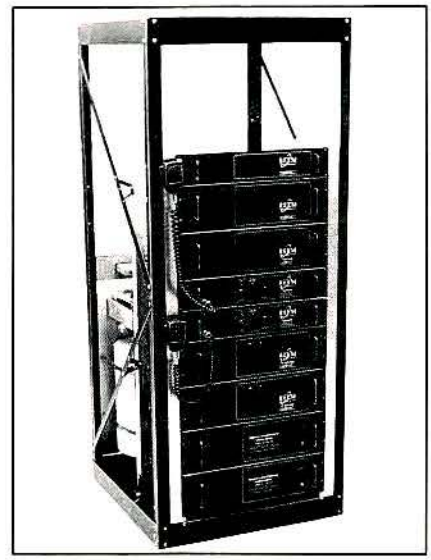
Panasonic

- Synthesized (Programmable/Reprogrammable)
 - VHF (980 frequencies) – Cap Codes
 - UHF (400 frequencies) – Pager Functions
 - 900mhz
- POCSAG Signaling Format
- Up to 8 Address Capability
- Vibrator Standard

VCP INTERNATIONAL, INC. DALLAS, TEXAS
COMMUNICATIONS DIVISION
P.O. Box 550999 Dallas, TX 75355-0999 Toll-Free 1-800-527-9366 FAX (214) 278-5981

Circle (82) on Fast Fact Card

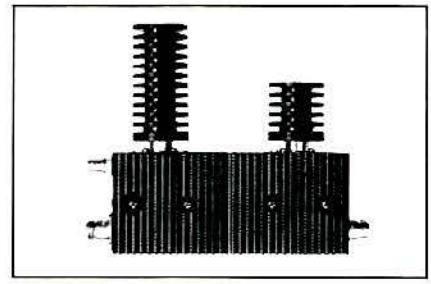
Dual repeater system boasts custom package



The System dual repeater or base station system from **Relm Communications** can be made to meet custom requests quickly and cost-effectively. The product features transmit and receive combiners preconnected and housed in a single package. The unit starts out as a combination of stock products in a single open-rack style cabinet. It includes duplexers and a Zetron interface for CTCSS, DCS and telephone interconnect.

Circle (516) on Fast Fact Card

Ferrite isolator line features single-, dual-junction models



High-power ferrite isolators for 800MHz-to-960MHz band are available from **Wacom Products.** The product line includes single- and dual-junction models with transmit power of 150W, 250W and 350W. Numerous load terminations are available for use with the isolators.

Circle (273) on Fast Fact Card

Literature

Brochure describes extending radios range

Midland LMR describes how its Syn-Tech II vehicular repeater expands the range for its portables and mobiles. The brochure discusses options and gives specifications.

Circle (205) on Fast Fact Card

Catalog details switchmode rectifiers

Electrical specifications, operating characteristics and design benefits of the TwinPack switchmode rectifier systems series are detailed in **Power Conversion Products'** catalog. The 23-page publication outlines the advantages of each component in the series and provides easy-to-read charts and product photos.

Circle (202) on Fast Fact Card

Report examines 220MHz spectrum

Understanding 220-222MHz: A Businessman's Guide, by the **National Association of Business and Educational Radio (NABER),** analyzes the marketplace, equipment and technology, regulatory aspects, nationwide systems, financing, engineering and asset valuation concerning 220MHz-to-222MHz issues. Written by industry experts, each chapter examines the uses of and demands for the 220MHz-to-222MHz technologies.

Circle (206) on Fast Fact Card

Catalogs describe cellular, mobile antennas

Mobile and cellular antenna product lines are described in two **db Mobile** catalogs. The Land Mobile Products catalog lists 30MHz-to-50MHz lowband antennas; 130MHz-to-174MHz VHF antennas; 406MHz-to-512MHz, 400MHz-to-512MHz and 450MHz-to-512MHz UHF antennas; and 800MHz and 900MHz conventional antennas. The Cellular Products catalog lists body mount antennas, hand-held, flexible phone mounts and phone accessories. Each catalog lists electrical and mechanical data.

Circle (207) on Fast Fact Card

Catalog includes quartz crystals

Quartz crystals, hybrid clock oscillators and custom hybrids for industrial, commercial and military applications are featured in **M-tron Industries'** catalog. Facilities and capabilities are included with illustrations and engineering data sheets.

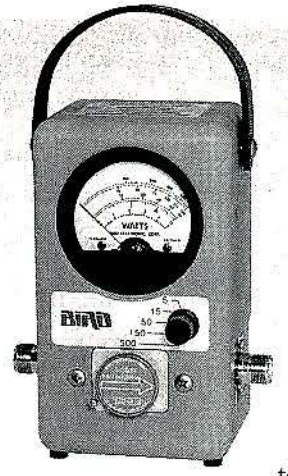
Circle (203) on Fast Fact Card

Video provides grounding overview

"Grounding—An Overview" is a video tutorial providing extensive information on grounding techniques for communication site protection from lightning. The video from **PolyPhaser** is the first of a series for technicians and engineers.

Circle (210) on Fast Fact Card

FROM 25-1000MHz . . . FROM 0-500W . . .
BIRD'S 4304A IS ALWAYS READY



This Model 4304A THRULINE® 25-1000MHz Broadband Directional Wattmeter is always ready to measure RF power. There are no elements to buy or change, ever. (Comes with 50-Ohm type UHF connectors, too.) Measure power with ±7% maximum full scale accuracy over ranges of 5, 15, 50, 150, and 500W to 800MHz . . . or up to 150W from 800-1000MHz. Read both FWD and RFL power by just rotating the built-in element. Change connectors easily, too — with our no-solder QC's (BNC, N, TNC, SMA, mini-UHF, etc.). Need a Bird that's ready when you are? Then order your own Model 4304A Broadband Directional THRULINE® RF Wattmeter today.

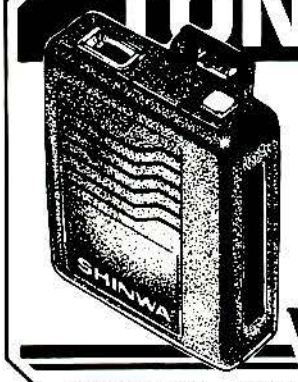
who else but BIRD

30303 Aurora Rd., Cleveland, OH 44139 U.S.A. (216) 248-1200 • TLX: 706898 Bird Elec UD
FAX: (216) 248-5426 • WESTERN REGION OFFICE: Ojai, CA • Phone: (805) 646-7255

© Copyright 1991 Bird Electronic Corp.

Circle (83) on Fast Fact Card

TONE & VOICE



SHINWA *SMALL, POWERFUL AND RELIABLE*

- Low band, VHF, UHF
- Two tone sequential
- Single "AA" battery
- Variable volume control
- Locking battery compartment
- Group call command
- Three year warranty

VCP INTERNATIONAL, INC. DALLAS, TEXAS
COMMUNICATIONS DIVISION
P.O. Box 550999 Dallas, TX 75355-0999 Wats 800-527-9366 FAX # (214) 278-5981

Circle (84) on Fast Fact Card

Maintaining equipment obtains high rating

Maintaining communications equipment on a regular schedule, including preventive maintenance, is important, according to respondents to the June 1991 "What Do You Think?" questionnaire. Statistics point to 71% of the respondents maintaining equipment on a regular schedule.

Not only is keeping equipment in proper working order important, but staying knowledgeable with up-to-date test and tune-up procedures is crucial to communications systems. The majority of the respondents, 74.2%, keep up with repair and test procedures.

Maintenance tips readers have for communications equipment servicing and repair include:

- "Battery conditioning, battery terminal cleaning, cleaning plug-in board connectors and SWR checks—monthly."
- "Be thoroughly familiar with the system you are working on."
- "Check everything even after retuning. Test under power. Do not reset frequency in extreme high or low temperatures."
- "Check the basics first: wiring connections, voltages, antennas and fuses so as not to make the problems harder than they are."
- "Do bench work before or after business hours with the door closed and the phones unplugged."
- "Ensure test equipment is working and meeting specifications."
- "If it works, do not mess around with it. Check sensitivity, frequency and power."
- "Pay particular attention to detail. The small things can cause major difficulty."
- "With repeaters in remote locations, I like to pull all of the cords once a year and clean edge connectors with an eraser or cleaning solution to prevent intermittent problems."
- "Keep data flow on repairs in the mainframe, tagging equipment and record logs at repeater sites and base control."
- "Keep equipment clean."

Base stations, repeaters

Readers cite problems and hindrances encountered in maintaining base stations and repeaters:

- "Allocating down time for service."
- "Outside interference that you will never find—radio stations getting into equipment—trying to get rid of it."
- "Snow, ice and some roads."
- "Tight spaces in buildings and inclement weather."
- "Site problems with other users' radios causing intermod or difficulty in getting meter readings."
- "The remote locations of our repeaters are only accessible three months out of the year."
- "Isolating base station and telco problems."
- "It is hard to get the system on down time from heavy radio traffic use."

Mobiles, portables

Maintaining mobiles and portables also has problems, readers report:

- "Chip component replacement is a problem."
- "Isolating problems—radio looks great on the bench but will not work in the field."
- "Cleaning up poor installs by others and poor maintenance by others."
- "Service manuals do not seem to have as much useful information."
- "The biggest problems I have with mobiles and portables are the mechanical switches involved with them sticking or breaking, especially with the older radios."

The ULTIMATE PROTECTION...

NOBODY...but NOBODY beats the quality and workmanship of LEATHERSMITH's cases for two-way radio equipment.

LEATHERSMITH's specially-developed, steer hide leather cases are expertly designed by Pennsylvania craftsmen.

LEATHERSMITH's cases feature durable, rust-proof nickle-plated snaps and fasteners. Quick disconnect swivels are optional on all models in polished steel and sturdy molded nylon.

Your choice of covers is included in our low,low prices.

Rich, full-grained leather cases for the latest models in stock now!



LOGO IMPRINTS IN CHOICE OF COLORS

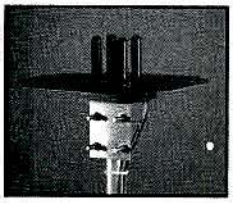
"Delivered on time ALL the time!"
Call TODAY for your FREE information pack
Toll-Free 1-800-233-0440 Fax 1-717-270-2912

The Right Choice

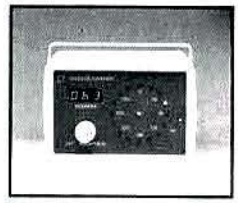
LEATHERSMITH 2001 Maple St. LEBANON, PA 17042

Circle (85) on Fast Fact Card

INTERFERENCE LOCATION



★ 50 to 1000 MHZ
★ Stuck Microphones
★ Cable TV Leaks
★ Jammed Repeaters & Cell Sites



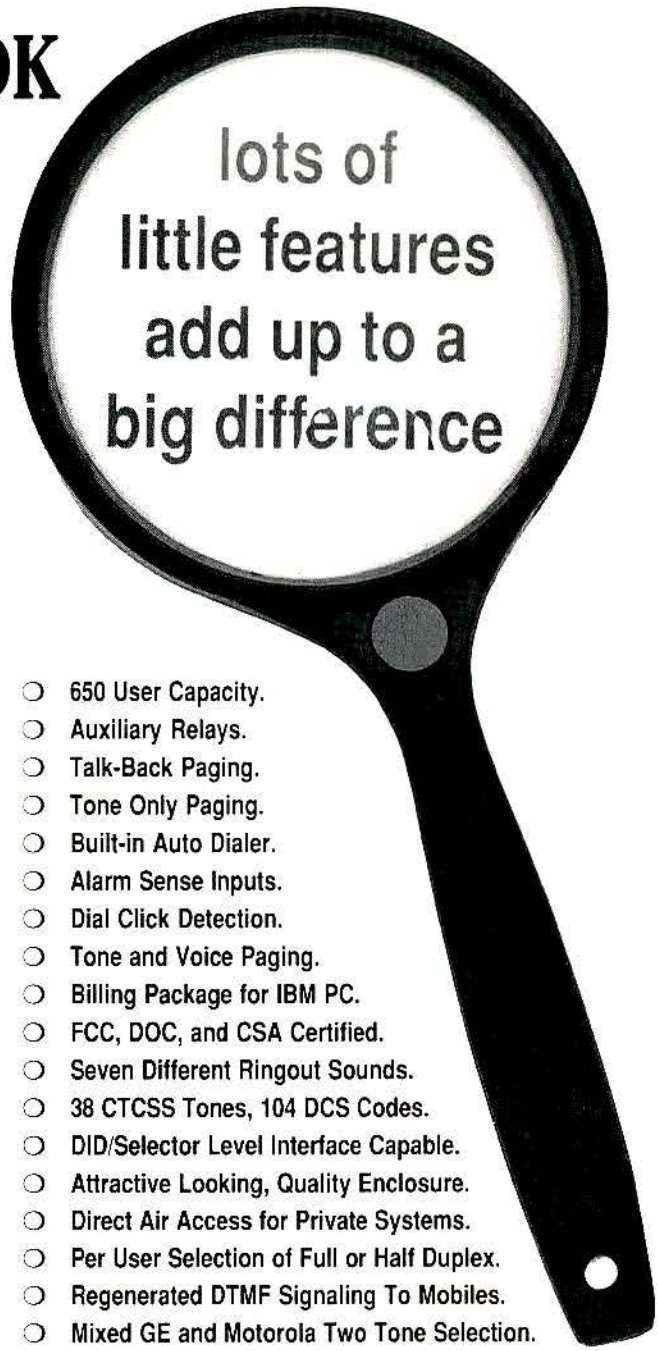
New Technology (patented) converts any VHF or UHF FM receiver into a sensitive Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Models available with computer interface, synthesized speech, fixed site or mobile - 50 MHz to 1 GHz. Call or write for details.

DOPPLER SYSTEMS, INC. P.O. Box 31819 Phoenix, AZ 85046 (602) 488-9755 FAX (602) 488-1295

Circle (86) on Fast Fact Card

If You Think All Phone Patches Are The Same,

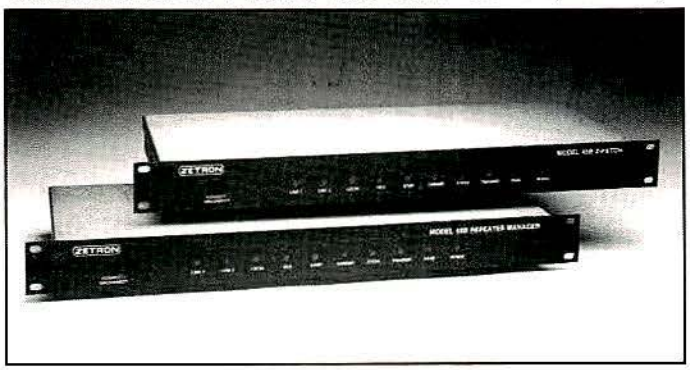
TAKE A CLOSER LOOK



- **Zetron Exclusive:** "DIGIT LOCK" for extended DTMF decoding range.
- **RS-232 Port:** lets system operator print out call detail information and easily program phone patch.
- **Internal 300/1200 Baud Modem:** allows remote programming on same phone line that is used by patch. Also allows factory service personnel to aid in servicing unit.
- **Upload/Download Capability:** allows system operator to safely store system programming information.
- **Multiple Phone Line Capability (2 to 16 lines):** allows customers to have their own dedicated phone line.
- **Voice Prompts:** instruct phone callers on how to use the system.
- **Selectable Pulse or Regenerated Dialing to Phone System**
- **Rings and Progress Tones:** with correct timing and sounds.
- **Privacy Mode:** allows mobile to talk to phone party without being monitored by other users on system.
- **Automatic Error Checking:** when transferring data to or from patch.
- **Internal Memory Buffer:** stores call detail information.
- **Unattended Auto Call Function:** allows page to be automatically sent when a special phone line is called.
- **Second Dial-Tone Disconnect:** prohibits toll restriction from being easily defeated.
- **Toll Restrictions & Calling Privileges:** on a per user basis.
- **Flexible Timers & Parameters:** allow the system to be fine tuned.
- **Superior Sounding Audio:** that will impress your customers.
- **Flexible Connect & Disconnect Sequences:** which can include variable length ANIs or fast ANI.
- **Simplex VOX, Digital Delay, and Sampling:** for optimum simplex capability.
- **CTCSS and DCS Signaling:** for duration of call or only during selective signaling or until mobile answers.
- **Multiple Call Limit Timers:** can be assigned on a per user basis.
- **Built-in Community Repeater Panel.**

Some features listed are optional. Consult factory for configuration information.

Zetron's Model 45 Z-PATCH Telephone Interconnect and Model 48 Repeater Manager



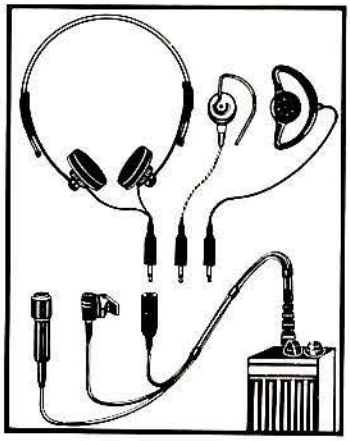
- **650 User Capacity.**
- **Auxiliary Relays.**
- **Talk-Back Paging.**
- **Tone Only Paging.**
- **Built-in Auto Dialer.**
- **Alarm Sense Inputs.**
- **Dial Click Detection.**
- **Tone and Voice Paging.**
- **Billing Package for IBM PC.**
- **FCC, DOC, and CSA Certified.**
- **Seven Different Ringout Sounds.**
- **38 CTCSS Tones, 104 DCS Codes.**
- **DID/Selector Level Interface Capable.**
- **Attractive Looking, Quality Enclosure.**
- **Direct Air Access for Private Systems.**
- **Per User Selection of Full or Half Duplex.**
- **Regenerated DTMF Signaling To Mobiles.**
- **Mixed GE and Motorola Two Tone Selection.**
- **Compatible with Zetron's Model 36 Phone Link.**
- **Mobile to Mobile, and Mobile to Pager Capability.**

Zetron, Inc.
12335 134th Ct. N.E. Redmond WA 98052
Tel: (206) 820-6363 Fax: (206) 820-7031

ZETRON

Circle (39) on Fast Fact Card

SONIC
Sound Technology Working for You



SONIC HD-13

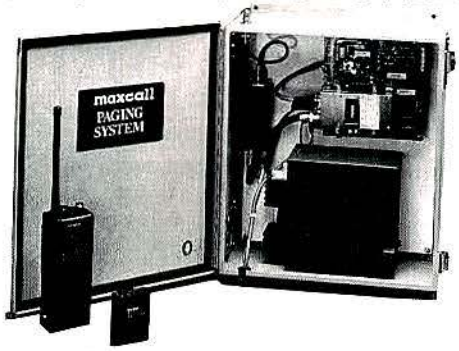
THE MOST VERSATILE AUDIO ACCESSORY AVAILABLE FOR YOUR TWO WAY RADIO. BUILT FOR WHERE YOU WORK.

Sonic Communications, Inc.
4 Colonial Center, Box 287
New Ipswich N.H. 03071 USA
Tel: 603-878 1944
Fax: 603-878 1773



Circle (87) on Fast Fact Card

ON-SITE PAGING POWER



25 Watts of power for about the same price as other lower power systems. That's the **maxcall**™ advantage... So, why take a chance on a 2, 4 or 5 watt system being able to meet your needs?

UHF or VHF, a mix of digital and analog paging in a single compact unit with power levels of 2, 5, 25 or 100 watts.

Call today for more information!

maxon
PAGING PRODUCTS
10828 NW Air World Drive
Kansas City, MO 64153
816-891-6320
FAX 816-891-8815
TLX 153252506 MAXONKC

© 1991 – Maxon Paging Products

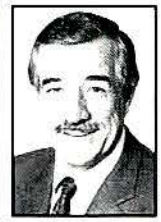
Circle (88) on Fast Fact Card

People


Sweeney


Hitchcock


Shanfeld


Walters

Kathy Sweeney leaves Hark Systems, Summerville, SC, as director of marketing to join International Voice Messaging Systems, Bountiful, UT, as sales manager for the IVM phone messenger line.

Changes at Antenna Specialists, Cleveland:

Craig Hitchcock exits NEC America, Richardson, TX, as account manager to join Antenna Specialists as manager of major accounts for its 13-state western region and Canada.

Paul Shanfeld leaves Celwave, Marlboro, NJ, as sales engineer and market developer to become product manager for Antenna Specialists' site management and Extend-A-Cell products.

Larry Kline, vice president of product marketing and sales, retires from Antenna Specialists for health reasons. Mr. Kline joined the company as director of engineering in 1964.

William Walters exits Mansoor Electronics as sales manager to join Midland International, Kansas City, MO, as eastern regional manager.

Promotions at Peninsula Engineering Group, San Carlos, CA:

Edward D. Sherman moves up from vice president of operations to president of Peninsula Engineering.

Frank P. Meng advances from director of international sales to the newly created position of vice president of international sales and marketing.

Terry Giles leaves MicroAge Computer Stores as senior vice president of finance and administration to join TekNow, Phoenix, AZ, as chief operating officer.

Ron Kabler leaves Bendix/King, Lawrence, KS, as engineering group leader to join Transcrypt International, Lincoln, NE, as engineering manager.

Appointments at db Mobile, Dallas, a new division of Alliance Telecommunications and a sister company to Decibel Products:

William O. Hunt adds responsibilities as division president to his duties as Alliance chairman.

Jim Rice exits Unipage, Desoto, TX, as executive vice president for the same position at db Mobile.

Randy Friedberg departs Celwave, Marlboro, NJ, as marketing manager to join db Mobile as sales vice president.

Former Maxrad chief engineer **Allen DeMarre** joins db Mobile as engineering vice president.

Calendar

1992

February

7-13—Cellular Telecommunications Industry Association 1992 Winter Meeting and Exposition, New Orleans. Contact: 202-785-0081.

18-20—International Mobile Communications Expo/Spring, Las Vegas Convention Center, Las Vegas. Contact: 303-220-0600.

March

29-April 1—Energy Telecommunications and Electrical Association '92, Dallas Convention Center, Dallas. Contact: 214-235-0655.

April

12-15—North Central Regional Conference Associated Public-Safety Communications Officers Meeting, Pheasant Run Resort and Convention Center, St. Charles, IL. Contact: T.G. Mieure, 708-244-8640.

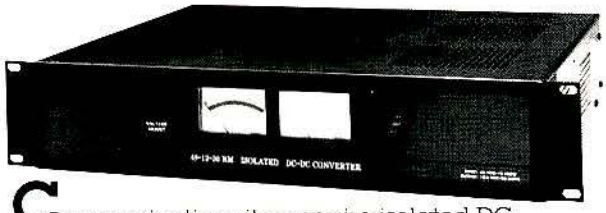
May

7-9—1992 Annual Mobile Communications Conference, Westin ANA Hotel and Resort, Washington, DC. Contact: National Association of Business and Educational Radio, 800-759-0300.

11-13—Vehicular Technology Conference, sponsored by IEEE Vehicular Technology Society, Hyatt Regency, Denver. Contact: John Tary, 303-452-6111, ext. 443.

13-15—Radiocomm Annual Convention, Montreal. Contact: Lisa La Prairie, 613-233-4888.

When The Spec Calls For Excellent Voltage Regulation, Low Noise, And High Efficiency, Call NEWMAR.



Communication sites require isolated DC-converters to provide excellent voltage regulation, low noise, and high efficiency. Reliability is vital under continuous duty operation and high ambient temperatures. All these aspects were incorporated in the design of NEWMARS rackmount DC-converters.

These units accept 48 VDC positive or negative input and produce pure 12 or 24 volt power. The solid state circuitry is conservatively designed and semi-conductors are selected and tested to withstand 100% more power than required during normal operation.

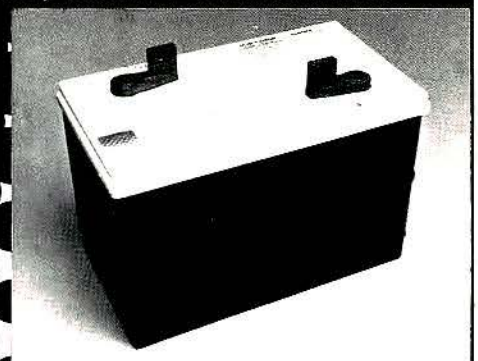
NEWMAR®

RELIABILITY BEYOND COMPARE

Phone: (800) 854-3906 • FAX (714) 957-1621

Circle (90) on Fast Fact Card

Solar/Cell Batteries



Introducing the SC series of lead acid deep cycle batteries designed for extreme cyclic charging and discharging applications

- **Deep Cycle Dependability**
- **Sealed/Maintenance Free**
- **Advanced Gell Electrolyte**
- **In Stock - Immediate Delivery**

For all your remote power needs:

Featuring Siemens Solar Modules

1-800-344-2003

SES SOLAR ELECTRIC SPECIALTIES CO.

P.O. BOX 537, WILLITS, CA 95490

Circle (89) on Fast Fact Card

BEE™

Quality Leather Cases

We're working our hides for you!

Two-way / Cellular / Paging

We stock more quality top-grain leather cases than anyone else in the Industry. Our manufacturing techniques match the advanced specifications of the latest in Portable Radio, Pager or Cellular models.



- **Immediate delivery** from large inventory.
- **Two day delivery** on set up orders.
- **Logo imprinting.** ■ Low pricing.

If you're not getting this kind of service ...call today.

Your one-call supplier for Hard Protection and Soft Leather Cases.

BEE Electronics, Inc.

2655 Gardner Road, Broadview, IL. 60153

Toll Free:800/336-3115 Fax:800/345-2091

Circle (91) on Fast Fact Card

Professional services

COMMUNICATIONS CONSULTING SERVICES

RAM

10 Woodbridge Center Drive
Woodbridge, NJ 07095
(908) 636-6970
Toll-Free: (800) 247-4796 • FAX:(908) 636-7260

COMMUNICATIONS CONSULTANTS, INC.

Offices in: Albany, NY Alexandria, VA Boston, MA Detroit, MI Ft. Lauderdale, FL Honolulu, HI Houston, TX Phoenix, AZ Richmond, VA San Diego, CA London, England

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- $37.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID

Smith Communications Service
2121 Parrish Ave., Owensboro, KY 42301
502-683-0936

PORTA-TECH
PORTABLE TECHNICAL SERVICE, INC.
1106 Laxton Road • Lynchburg, VA 24502

FACTORY TRAINED TECHNICIANS FOR QUALITY SERVICE

GE Portable Radio Service Depot
Factory Approved Nationwide
- Current Product Lines
- Voice Guard Certified
- Public Service Trunking
- Surface Mount Technology

(804) 239-3049

Communications Technology Associates
A division of Hayes, Seay, Mattern & Mattern, Inc.

PLANNING AND DESIGN:
- 2-Way Radio
- MW & F/O
- CAD/MDT/AVL/Paging

PLUS:
- Complete A&E Services
- Bldgs, Towers, Pwr Sys
- Structural Engineering

CTA

SFA INC.
(301) 925-9400
(800) 288-1-SFA
Fax (301) 925-8612
Telecommunication & Information Science Division
Public Safety, Transit, Government & Industry
MIRZA M. AHMAD
Senior Engineer
CORPORATE OFFICE
1401 McCormick Drive
Landover, Maryland 20785

TCS
Jerry L. Simmons
Communications Systems Consulting
Land Mobile & Microwave Systems
P O Box 884
Montgomery, TX 77356
Ph (409) 588-3200
Fax (409) 588-4434

FREDERICK G. GRIFFIN, P.C.
3229 WATERLICK ROAD
LYNCHBURG, VA 24502
TEL. (804)237-2044/FAX: (804)237-6063
NATIONWIDE COMMUNICATIONS CONSULTING
MOBILE RADIO, MICROWAVE, E9-1-1
CAD, PAGING, LAN
DISPATCH COMMUNICATIONS CENTERS
MULTI SITE PROPAGATION ANALYSIS

THE PORTABLE DEPOT, Inc.
SPECIALIZING IN GENERAL ELECTRIC PORTABLE SERVICE
• FACTORY TRAINED TECHNICIANS •
•SURFACE MOUNT TECHNOLOGY •
• FACTORY APPROVED NATIONWIDE •
• PUBLIC SERVICE TRUNKING •
• VOICE GUARD CERTIFIED •
Route 2, Box 338C • Lynchburg VA 24501
within 5 miles of the factory
804-237-3427

GET THE EDGE OVER YOUR COMPETITOR
ADVERTISE IN
MOBILE RADIO TECHNOLOGY CLASSIFIEDS
Call Carla Gamino at
303-762-1249 Fax 303-762-0069

OMNICOM, Inc.
COMMUNICATIONS ENGINEERING
GENE A. BUZZI

RCT
RAYMOND C. TROTT
CONSULTING ENGINEERS, INC.
1425 GREENWAY DRIVE SUITE 350
IRVING, TEXAS 75038
214/580 1911
RAYMOND C. TROTT, P.E.
PRESIDENT
LAND MOBILE MICROWAVE COMMUNICATIONS SYSTEMS

MCCON
Mobile Communications Consulting
S. R. McConoughey, P.E.
Principal
13017 Chestnut Oak Drive
Gaithersburg, MD 20878
(301) 926-2837

EEA
(517) 351-3252
R. James Evans
President
Evans & Evans Associates, Inc.
Communications Consultants
2803 Southwood Drive
East Lansing, MI 48823

Stuart Meyer
LAND MOBILE CONSULTANT
2417 NEWTON ST
VIENNA, VA 22180
(703) 281-3806
FCC CALL
KB83540

HERB SACHS, CONSULTING
Specialist in Public Safety Communications
P.O. Box 729
Bowie, MD 20715
301-464-4268

GET THE EDGE OVER YOUR COMPETITOR!
Advertise where you'll get the most for your ad dollar, MRT Classifieds.
Call Carla Gamino
303-762-1249 ♦ Fax: 303-762-0069

Classified

Advertising rates in **Mobile Radio Technology's** Classified Section are $69.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in ¼-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest ¼ inch.

Blind box ads (replies sent to **MRT** for forwarding) are $30.00 and Fast Fact reader service numbers are available for $25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by **MRT** on an issue-by-issue basis, is available at $150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisers who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Carla Gamino at (303) 762-1249 or fax (303) 762-0069 to place your classified ad. Or send your advertising materials and order to Lisa Cunningham, **Mobile Radio Technology**, Classified Advertising Department, 9221 Quivira Rd., Overland Park, KS 66215.

Help wanted

APPLICATIONS/FIELD ENGINEER

DATARADIO A rapidly growing radio data communications company seeks a technical person for its Atlanta operation. Responsibilities include pre and post sales technical support, customer training, and proposal development. Candidates will have 3-5 years experience in mobile radio design and implementation of VHF, UHF and 800 MHz trunking/conventional systems. Experience with mobile data systems preferred. BSEE or equivalent required. Travel necessary. Compensation includes salary, paid benefits and bonus. Send resume, salary history and references to: ***Steven J. Beeferman,***

DATARADIO CORPORATION,
400 Perimeter Center Terrace,
Suite 999, Atlanta, GA 30346

TECHNICIAN

Large well established sales/service organization in Indianapolis is looking for experienced only commercial two-way radio technicians to join our service team. We offer excellent salaries and benefits. Communications Maintenance, Inc. 5351 West Minnesota St., Indianapolis, IN 46241 or 1-800-288-2430

COMMUNICATIONS MANAGER

The City of Corpus Christi is accepting applications for the position of Communications Manager. This position is responsible for management of a regional GE 800 MhZ trunked radio system, a U.S. West CAD system and a Southwestern Bell E 9-1-1 system. Responsible for a $1.4 million budget and supervision of 53 personnel.

Desired qualifications include a BA in electronics, engineering or a related field and 5 years of communications management, preferably 800 MhZ trunked system. Experience in emergency communications preferred.

Mail resume with documentation verifying education requirements to Susan Brown, Human Resources Department, P. O. Box 9277, Corpus Christi, Texas 78469.

Deadline: Open until filled.
Salary Range: $31,724-$45,629 Annually.
Equal Opportunity/Affirmative Action Employer/M/F/H

Help wanted

PageNet, the largest paging company in the U.S., has aggressive plans for continued growth nationwide. Currently, we have opportunities for qualified professionals to participate in the expansion and maintenance of our state-of-the-art paging network. Openings exist in various cities throughout the U.S. for the following:

Regional Systems Manager

You will have responsibility for maintaining existing systems and creating plans for future development on a regional basis. Ideal candidates will possess 3-5+ years related experience, an in-depth knowledge of state-of-the-art paging systems and a background in technical management.

System Manager

In this position, you will have responsibility for the design, engineering, construction and continued growth and reliability of the complete paging system. We require a working knowledge of paging systems and/or RF transmitters; experience managing technicians is a plus.

We offer competitive salaries and a full range of medical and other insurance benefits. Qualified applicants should send resume with salary history and requirements to: **Paging Network, Inc., Dept. HR-MRT, 4965 Preston Park Blvd., Suite 500, Plano, TX 75093.**

PAGENET

Equal Opportunity Employer
No Phone Calls Please
Principals Only

CELLULAR OPPORTUNITIES

National openings for experienced Cell Site Techs, Switch Tech, and other TECHNICAL PERSONNEL at all levels within Cellular Communications. Locations in a number of markets.

LAWRENCE PERSONNEL

1000 Valley Forge Circle
King of Prussia, PA 19406
215-783-5400; 215-783-6008 (FAX)
COMMUNICATIONS RECRUITMENT SINCE 1957.

COMMUNICATIONS ENGINEER

OMNICOM, Inc. is seeking land mobile radio communications consulting engineers with a minimum of 5 years experience in Public Safety radio communications system engineering.

Applicants for this position must posses a Bachelor of Science in Electrical or Electronic Engineering and a minimum of 5 years experience in public safety land mobile radio systems, including communication center design, microwave system applications, and knowledge of related technologies such as CAD, MDT and AVL. 800 MHz trunked radio system experience is preferred. The position involves a high level of direct client contact, which requires interpersonal skills and the ability to prepare and present reports. Benefits include health insurance, life insurance, profit sharing plan, annual leave, sick leave and paid holidays.

Send resumes to:

OMNICOM, INC,
930 Thomasville Road, Suite 200
Tallahassee, FL 32303

Personnel Available

EMPLOYEES AVAILABLE

Cellular Two-Way Paging
• Executive • Management • Marketing
• Sales • Engineers • Technicians
NATIONAL RESOURCE OF PERSONNEL
Employers: Call 606-491-5410
—Applicants Welcome!—
Send resume, area preference and salary requirement to address below. Fees are company paid.

Communication Resources
The communication personnel specialists
PO Box 141397 • Cincinnati, OH 45250
606-491-5410 / FAX 606-491-4340

Equipment for sale

HAVING AN IDENTITY CRISIS?



FELIX SEZ: LET US FIX IT!
LABELS & NAMEPLATES
FOR
PAGER, RADIO, CELLULAR
also REWARD LABELS
Your Logo and Company ID Imprinted
•No Minimum Order •No Set Up Charges
Send For Free Samples

ADVANCE LABEL & TAG
1725 N. McDonald McKinney, Texas 75069
1-800-777-9794 FAX(214)548-2518

Equipment for sale

PA1/PA2

MOTOROLA RADIO PROGRAMMING ADAPTORS
- IBM AT/XT compatible
- Supports full spectrum of programmable Motorola radios
- Includes AC wall adaptor, XT/AT adaptor cable, serial extender cable, manual, 1 year warranty

PA 1 $169.00

Program Your Radios IN-HOUSE

Additional Features of PA 2
- Rechargeable NI-CADs
- On/Off switch & Charge LED
- Data Transfer light

PA 2 $195.00



RADIUS, HT600, SABER...

Full Line of Radio Cables Available

Order By 1 PM & We'll Ship That Day

1-800-752-3571

MasterCard VISA DISCOVER COD

SCC Southern Computer Corp.

141 W. Wieuca Rd. • Suite 300-B • Atlanta, GA 30342-3219 • 404-252-3340 • FAX 404-252-8929

Circle (102) on Fast Fact Card

Now Available

GP — 300

Radio Programming Cables
Full Line Available
1-800-752-3571
Southern Computer Corp.

Dual Control Head Adapter for EFJ Challenger Mobiles

Mark Bitting Inc.
P.O. Box 13; New Cumberland, PA 17070
(717) 774-7203

EVERYBODY'S DOING IT!

Re-crystalling

their Pagers and Radios With STANDARD'S Quality Crystals.

CRYSTALS AVAILABLE FOR: MOTOROLA, G.E., N.E.C. AND ALL OTHER MAKES.

TOP QUALITY, ULTRA HIGH SHOCK CRYSTALS.

Expedited delivery service available.
24 hr./72 hr./5 day/8 day/10 day
Normal 15 days

Standard Communications

Call 800-800-9825 (in U.S.)
(in 213 area code, call 532-5300)
FAX 213-769-0154
Frequency Management Division
P.O. Box 92151, Los Angeles, CA 90009-2151

Circle (103) on Fast Fact Card

MOTOROLA • HAEWA • IDA • JOHNSON • KENWOOD • KING • MAXON • VEGA • YAESU • MIDLAND • GE • RANGER • STANDARD • UNIDEN

RadioMate®

Professional Headsets for Professional People™

Portables • Mobiles • Base Stations • Telephones

CALL FOR COMPLETE BROCHURE

1-800-346-6442

Circle (104) on Fast Fact Card

USED PAGERS

Motorola and NEC. Reconditioned on your channel w/warranty or as is.

ACS (303) 337-4811
FAX (303) 337-3084

FOR SALE

Used GE-MARC Trunking Radios.
Call John Peacock
800-232-7715

RADIUS P10

★low-low-low-low★

MOSS COMMUNICATIONS
1-800-767-1963

MOTOROLA

RECONDITIONED RADIOS
HUNDREDS IN STOCK
800-231-0103
CALIFORNIA RADIO

USED 2-WAY RADIOS
Call Sid Cohen
at AIR COMM—Phoenix, AZ
(602)275-4505 • Fax (602)275-4555

30%-70% savings on Motorola, GE, EFJ mobiles, base stations, portables, pagers, repeaters—primarily solid state—all frequency bands. Also, accessory items: Motorola "**Systems 90**" control heads. **PL and paging reeds**, channel elements. Cash quotations made for purchase of above equipment.

AIR COMM 4614 E. McDowell Rd. Phoenix, AZ 85008

CHANNEL ELEMENTS REBUILT

- ☐ Lifetime guarantee on Bomar Crystals
- ☐ Competitive pricing
- ☐ 48-hour, 1-week and 2-3 week service

CALL 800-526-3935 FAX 800-777-2197

IN NJ: 908-356-7787

BOMAR

201 Blackford Avenue • Middlesex, NJ 08846

Circle (105) on Fast Fact Card

Equipment for sale

MOTOROLA GOODIES

MSF5000 UHF REPEATERS - 110 w. cont. w/dplxr. As New! W/tone ctrl. $4,850.
MITREK - 110 watt, 30-50 Mhz. pl/dpl, 4 ch. MINT! Single $495. 10+ units $395.
EXPO Portables. 450-470 MINT! Universal, 2 ch. Pl or Dpl. 2 simplex ch. $395.
12 watt AMPLIFIED SPEAKERS - From MX and MT500 Convertacoms. $29.
MARATRAC MOBILES - 110 w, UHF pl/dpl, 16 ch. PROGRAMMED & MINT! $795.
T1617CM Tone Remote units. 1 BRAND NEW (4ch) $1,900. 1 used 8 ch. $1,500.
STX/MX 6 pocket, 1 hr. chgrs. NLN8988. NSO= $586. Only 15 left! Sell for $195.
MICOR 150-160 - 110 watt, pl. On your frequency & reconditioned. $495.
MOCOM 70 150-160 - 110 watt, pl. On your frequency & reconditioned. $275.
MAXAR 80, MOXY, MAXAR LOCKING BRACKET ASSEMBLY (2 halves). $9.
HUNDREDS of reconditioned mobiles in stock. Most frequency ranges...CALL!
TONE REMOTE ADAPTORS for Maxtrac/Radius. Mint! L1548A/TDN8301. $295
PT300 PACKAGE. W/2 radios, 1 chgr. As is. 48.58 Mhz. All for $99. (No nicads)

If you don't see it..... CALL!

CALIFORNIA RADIO 16943 - 6200 Road Montrose, Colorado 81401
Orders: 800-231-0103 Info: 303-249-1414 Fax: 303-249-4334

Hy-Q International (USA)

- ☐ **PAGER CRYSTALS**
- ☐ **COMMUNICATION CRYSTALS**
- ☐ **CHANNEL ELEMENTS**
 - ■ Recrystalled
 - ■ Compensated
 - ■ Complete Elements

(606) 283-5000
FAX: 1-606-283-0883
1438 Cox Ave., Erlanger, KY 41018
(Greater Cincinnati Area)

"Precision Quality Quartz Crystals Made to Your Specifications"

48-HOUR SERVICE AVAILABLE

Circle (106) on Fast Fact Card

Mobile Extender DGME 1000
Delay Gated Repeater Maker DGRM 501
The DGRM 501 provides for repeater operation while the DGME 1000 provides for mobile extended operation with use of most any two transceivers. Repeater, Extend, Cross Band & Link operation. Digital gate circuit for positive control and min. power draw. DGRM 501 & 501B ideal for remote locations.

DGRM 501 $89.00 | DGRM 501B & DGME 1000 $169.00

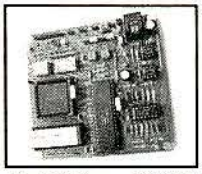
NEW! Programmable Delay Timer DG 200 Series NEW!
This unit provides control of radio with delayed shut down after ignition is turned off. The DG 200 Series is a dip switch programmable timer with delayed time settings of 15 min to 12+ hrs. This unit will handle 30 continuous amps at 12V. The DG Series timer eliminates battery failure due to leaving mobile, computer, AVL, MDT, Trunking or other equipment inadvertently.

DG 200 Series $38.00

COMM—NET 2000
COMMUNICATIONS/MANUFACTURING
P. O. Box 20 5407 N.E. Stephens
Winchester, Oregon 97495,
1 year limited warranty

Order 1-800-283-5158 Made in the USA Fax (503) 672-6475

Natural Voice Playback



- ■ Repeater Identifiers
- ■ Site Alarms
- ■ Remote Telemetry
- ■ Weather Stations
- ■ Multiple Languages
- ■ Emergency Announcements

DataVoice - DV-64

Add a *Recorded Natural Voice* to your system or equipment. Voice vocabularies consisting of over 100 words or **multiple phrases** up to 1 minute in a ***Natural Voice*** is saved in Non-Volatile E-Prom memory. (If power is removed the recordings will not be lost). We'll record your message(s) in a male or female voice - or - you can record the library by using the optional SDS-1000 development board on an IBM or compatible computer.

Parallel input word select	8 ohm Audio output
500 ma keyline output	600 ohm Audio output
32 Kb sampling rate	+9v to +14v supply
Multiple modes	Size: 4.00" × 4.25"
Selectable timing	Connectors included

Several different models available

Palomar Telecom, Inc.
300 Enterprise St., Suite E - Escondido, Ca. 92025
(619) 746-7998 • Fax (619) 746-1610

Motorola/Radius Upgrades and Conversions

Upgrade your existing Conventional *AND* Trunked equipment with:
Additional Modes,
Scan, Signalling Systems and
"Out of Band" Frequencies
Multi-Frequency Conversions for HT-600 and P200 $29.95
Standard Programming and Repairs also available

RadMax Communications
COMPLETE COMMUNICATIONS SERVICE
10677 Indianwoods Drive, Cincinnati, Ohio 45242
513-489-1732

MOTOROLA
CENTRACOM I & II
Console components
BOUGHT & SOLD
Telecommunications Engineering Associates
409 Wildwood Dr.
So. San Fran., CA 94080
Ph: (415) 871-4200

Circle (108) on Fast Fact Card

ICOM R1 & R100
The Ultimate scanners!
They're In - The official version!
Dealer: R1 $550 ppd *Include UPS address*
Dealer: R100 $615 ppd *and check w/order*
SWS Security
1300 Boyd Rd.
Street, MD 21154 301/879-4035

How Marty received important phone calls while visiting six clients in four cities in three countries on two continents in five days

. . . with only one phone number.

LOGOS . . . CALLING PEOPLE, NOT PLACES

LOGOS provides SELECT CALL-FORWARDING and THROUGH DIALING from a land line to any phone number anywhere, permitting compatibility with SMR's, Roaming Cellular, Private Interconnect, Paging and Wire-line systems, with or without over-dial.

Benefits:

- ■ **Select Call-Forwarding** lets you temporarily forward all calls or just important calls to another number that you select.
- ■ Requires only one phone line equipped with 3-way calling and DTMF signaling, available from your local phone company.
- ■ Remotely reprogrammable via user friendly Voice-Mail type prompts.
- ■ **Through Dialing** lets you use your office line when you are away from the office.
- ■ Allows you to lower long distance phone bills, pay phone costs, and extend your toll-free calling area.

Ask your representative for more information or call 1-800-442-4887

Logotronix™

Logotronix Communications LLC, 12141 Washington St., Thornton, CO 80241

Circle (107) on Fast Fact Card

Equipment for sale

Multi Line Select

Connect All Your Base Stations to ONE Remote!!!

- Tone Remote with up to 8 channels (F1-F8)
- Select up to 8 base stations
- Electronic rotary switch for line selection
- LED Line Activity indicators
- Monitor all capability
- Amphenol connector & cable supplied
- Add or delete any combo of receive audio.



AEE Automation & Electronics Engineering, Inc.

13667 Floyd Circle
Dallas, TX 75243
800-527-4596
800-383-9180 FAX

Circle (109) on Fast Fact Card

GENERAL COMMUNICATIONS

MIDLAND LMR LAND MOBILE RADIO

WHOLESALE PRICES ON ALL MIDLAND RADIOS!

CALL TODAY!

master card VISA 1-800-356-3200

5157 Anton Dr.
Madison, WI
53719

COOKS COMMUNICATIONS CORP.

master card VISA

(Authorized Dealer)

GENERAL ELECTRIC Mobile Radio

GE MOBILE AND PORTABLE RADIOS AT WHOLESALE PRICES

160 N. BROADWAY
FRESNO, CA 93701

1-800-233-8818

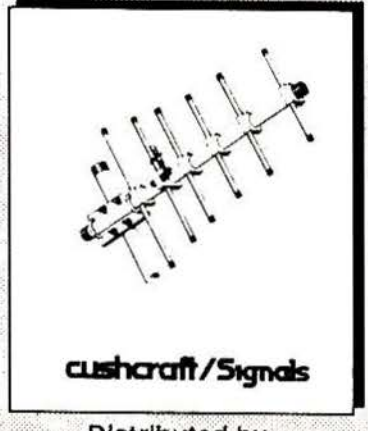
Start your new year right with C.W. WOLFE.

BASES/REPEATERS		MISCELLANEOUS	
MOT MICOR C53RTB1103 H.B. Local Control (like new)	$700	Reg PE Charger	$25
1 MOT Micor C64 Repeater Cont Duty	$2500	GE PE 3 Hour Rapid chargers	$55
MOBILES		Redicode DTMF Mics. MITREK MICOR SYNTOR Plugs	$20
Micor access., mikes 2 F. Scanhead	$65	25-MOT MC-70 Front Mt. control Heads	$10
40 GE Century II all access	$115	12 HT 220 12 pocket wall charger	$50
20 H.B. MVPs, clear, all access	$225	20 MVP Power Supplies w/remote & mike	$110
GE Mastr II UHF 40 Watt all access	$300	Federa PA-20 Interceptor, 100 watt, Siren Amp	$45
GE Delta "S" VHF 40 Watt 16 ch. drawer only	$90	**WANTED**	
MOT MT 500 VHF 4F w/PL as is	$80	LB Delta S 40-50	
MASTR II 40w	$250	**SPECIALS**	
MOT PT 500 VHF CSO, 4F & 8F	$125	50 Standard Series 300 Portables w/chrg., 139-150 MHz	$115
GE MASTR II UHF 100 watt drawer only	$400 $300	100 MOT Mtrneks mikes	$8
ACCESSORIES		CALL FOR CURRENT FLYER	
MASTR II Access Group	$80		

CW Wolfe COMMUNICATIONS

All sales cash or cashier's check. Fax: (406) 252-9617
1113 Central Ave. • Billings, MT 59102 406-252-9220

Look what Primus has in stock for same day shipment to you!!



Distributed by

primus ELECTRONICS CORPORATION

800-435-1636 • (IL) 800-892-1413
FAX: 800-767-7605

Circle (110) on Fast Fact Card

REPEATERS FOR SALE

Mot. MSF5000 AS NEW!!
110 W. UHF Continuous
w/TONE REMOTE!

800-231-0103
California Radio

$4975.

Equipment for sale

BUYING USED EQUIPMENT
CALL OR FAX FOR QUOTE

MASTR II UHF / VHF RPTR & BASE	$CALL
Delta-S 42-50 w/acc. new	599
Delta-S 42-50 no. acc. used	275
Delta-S 150-174 no. acc. 110W	275
Delta-S 494 90W 128 ch. new	699
Phoenix-SX UHF / VHF 16 ch. no. acc.	235
MASTR II 150-174 no acc. 110W	165
MPI port. 4W CG 150-174 new	225
S-700 weather proof scan control with all accessories new	225
S-990 128 ch head w/warranty	125
S-950 128 ch head w/warranty	75
C-800 scan control head	12
C-900 scan/multi CG encode	35
C-500 MASTR II control head	35
DB notch filter UHF pass/reject	165
MPS/MPR/MPX/MPI/MPD Chargers	Call

NEW LONDON TECHNOLOGY
231 Old Timberlake Road
Forest, Virginia 24551
TEL. 804-525-0068 FAX 804-525-0078

WHY SETTLE FOR ANYTHING LESS



New Motorola and NEC Pagers

One call can get it all...

- Competitive Prices
- Quantity Discounts
- Many Types Available



BRAVO

IDP5000
New Lower Prices on NEC Pagers

Also available:
- Reconditioned Pagers
- Recrystal code plugs
- Refurb Kits
- Batteries
- Parts

WE BUY PAGERS

McManus Communications
400 N. 5th
Blytheville, AR 72315
501-763-6250
FAX: 501-763-6533

Circle (111) on Fast Fact Card

FOR SALE
2GHz Collins Microwave Model #MS228-5 HOT Standby (4 transmitters, 4 receivers) on private carrier frequency in 7 foot rack.
$3000
Call Don Clark Radio
208-785-1430

Call Me Anytime
Motorola 2-Way Equipment
New-Used-Demos VHF-UHF-800-900MHz-Mobiles Portables-Base-Repeaters
Have something to sell, call us.
The Boys in Arizona don't sell to their competitors, but we do!
KEN SCOTT
SCOTT COMMUNICATIONS
406-745-3218

STOP

MOTOROLA RADIUS
End users shop first then call for best price.
Procomm
805-497-2397



Get Standard's Best Deals For Just A Little Scratch

Save up to 50% on radios and accessories!

We call them "B-Stock." You'll call them the best value in Land Mobile radios and accessories.

It's fully operational gear that meets factory specifications that we can't offer as new because it's got a scratch on the case, a marred finish, or some other minor glitch.

So we're offering our B-Stock at savings up to 50% off the price of our regular merchandise. Perfect for use as loaner, demo or rental equipment, or as a low-cost alternative for expanding systems.

You can order by phone with a credit card, or we'll ship COD.

Our B-Stock inventory is constantly changing, so call us today toll-free for our current equipment list.

Standard Communications

800/767-0204

1876 West North Temple
Salt Lake City, UT 84116

Circle (112) on Fast Fact Card

Classified

Equipment for sale

MIDLAND LMR Nationwide
LAND MOBILE RADIO

Factory Approved
WHOLESALE PRICES
- *Large Inventory • Fast Service • Flat Rate Repair Service*
- *Complete Dealer Support Program*

Dealers Only

(800) 726-9015
(612) 869-2487

SAME DAY SHIPPING
Call for Weekly Specials!
Refurbished Equipment Available

FAX (612) 869-3078

RCW DISTRIBUTING

816 W. 77½ Street
MPLS. MN 55423

Circle (113) on Fast Fact Card

FOR SALE

GE 100W VHF MASTR II	$135
GE 50W VHF MASTR II	$75 ea.
GE 100W LB MASTR II	$135 ea.
GE PL BOARDS MASTR II SERIES	$25 ea.
GE MLS MOBILE VHF	$250
GE MVP UHF MONITOR w/power supply	$125
GE MASTR PRO 33MHz MOBILE 100w	$39
MOT PP1000 800MHz trunked, excellent	$600
MOT SYNTOR SZ 800MHZ trunked, excellent	$300
MOT MITREK 100w UHF	$225
MOT MITREK 100w LB	$185
MOT MITREK 30w VHF	$135
MOT MICOR LB	Call
MOT MICOR 45W VHF	$65
MOT MOTRAC LB 100w	$39
MOT MICOR SCAN HEADS	$25
MIDLAND 70-056B 100w w/access	$375
HV POWER SUPPLY FOR ¼KW MICOR	$325

OKLAHOMA TWO-WAY
405-528-6467
VISA—MASTERCARD—DISCOVER

CLOSE OUT
RATELCO 12A-48V CHARGERS
Some new. . . $500 ea.

2 GHZ GTE LINKHURT MODEL
79F1-02 1 HOP + Spare
$2,000

WANTED
FARINON LR1-2

PHONE 818-308-0398
FAX 818-308-3909

SITE MANAGER SYSTEM / BC100 SITE MONITOR

1. 8 analog inputs • 8 digital inputs • 8 out
2. User set-up to monitor 1 to 8 transmitters
3. DTMF/FSK/RS-485
4. Unused inputs may monitor temperature, AC, etc.
5. Dial-Up phone • Radio • Wire pair
6. Host software for PC or compatible/RS232 from host computer, Operator may:
 - Set Hi/Lo Analog Limits
 - EN/DIS any analog/digital in or entire unit
 - Turn on/off the 8 controlled outputs
 - Interrogate site
 - Assign plain language names & units
7. Automatically reports alarms to host computer
8. Easily expanded to 255 units max. Add capability when needed.



Berry Controls Inc.
23 N. Central Ave. • Canonsburg, PA 15317
(412) 746-8888 FAX (412) 746-9189

Circle (114) on Fast Fact Card

Replacement Batteries

Centurion's full line of batteries to fit leading models perfectly.

For Two-Way Radios and Cordless Telephones

■ Motorola ■ GE ■ Uniden ■ Maxon ■ King
■ Midland ■ Cobra ■ AT&T ■ Radio Shack ■ Sanyo

For a distributor nearest you, please call
Toll Free 800-228-4563; or toll free fax 800-848-DUCK (3825)

CENTURION INTERNATIONAL, INC.
P.O. Box 82846 ■ Lincoln, NE 68501

Circle (115) on Fast Fact Card

RADIUS
WE'll BEAT YOUR BEST PRICE!
California Radio 800-231-0103

COMPLETE CHANNEL ELEMENTS ON YOUR FREQUENCY FOR $25 - $35!!!

ORDERS ONLY:
1-800-237-6519
INQUIRIES AND IN LA:
504-361-5525

- Motrac; Micor, Mocom; Mitrek; Etc. MT's, and GE Elements. Call for prices.
- Any desired Frequency available for fast delivery.
- Lifetime Warranty on Crystals
- Trade-in credit on your Old Channel Elements
- We Buy Used Elements

Try us first. We always have *your* frequency available.

NKX
1814 Hancock St.
Gretna, LA 70053

ARIZONA TWO WAY COMM.

MX BATTERIES "NEW"	$ 20.00
PP-1000	$600.00
MOSTAR 800 MHZ	$300.00
G.E. VHF MVP	$ 75.00
MOT & GE REEDS	$10.00-25.00
MICOR T44 DRAWER	$ 60.00
MICOR T54 W/S DRAWER	$ 75.00

BUY • SELL • TRADE
(602) 624-8200
RADIUS IN STOCK!

VersaTel COMMUNICATIONS
BUY-SELL-TRADE

40w Exec II UHF Base	40 Exec II VHF Base
100w Micor VHF Rptr.	100w Micor VHF Mobiles
30w Mitrek VHF	45w Micor UHF
30w Mitrek UHF	100w Mitrek VHF
50w Mocom 70 LB Cons.	30w Maxar 50 UHF
25w GE Century II VHF	100w Micor LB Base
100w Mastr II UHF	20w GE Century II UHF
100w Exec II UHF	100w Mastr II VHF
30w Aerotron UHF Syn.	75w Standard 966 LB
12 Open Steel Racks	24, 48 Volt Supplies
RCA 2 GHz CW62L	Collins 6 GHz MW318

• • SPECIALS • •

12V, 10Amp Power Supply	$49.95
Motorola MSR 2000, 110w, VHF, DC	$2450
GE Phoenix SX, 30w, 16 ch, VHF & UHF	CALL
Uniden AMH 300 30watt, 2 ch	$125

1-800-456-5548

Equipment for sale

MOTOROLA TRUNKED RADIO HEADQUARTERS

MOBILES & PORTABLES 800 MHZ

15 WATT TRAXAR	$250.00
15 WATT MOSTAR	$395.00
35 WATT MOSTAR 15 SYS/TEL ATM	$495.00
35 WATT MAXTRAC 10 SYS "B7"	$695.00
35 WATT SYNTOR ×2—×3	$250.00
35 WATT SYNTOR × 15 SYS/15 SUB/CONV	$995.00
35 WATT PP1000	$995.00
2 WATT MTX800 W/CHARGER	$645.00
2 WATT MTX810 2 SYS/3 SUB CHARGER	$695.00
3 WATT STX 15 SYS CHARGER	$995.00

MOBILES & PORTABLES 900 MHZ

12W B2 MAXTRAC	$495.00
12W & 30W B2-B5-B7 SPECTRA FROM	$695.00
2W MTX900 B3 & B4 6 SYS/3 SUB FROM	$795.00

CONVENTIONAL RADIOS

110 WATT MITREK VHF 4F PL	$595.00
100 WATT MITREK UHF 4F DPL	$595.00
30 WATT MITREK UHF 4F PL/DPL	$245.00
35 WATT MITREK 800 MHZ 4F PL	$275.00
30 WATT SPECTRA 900 MHZ B5	$745.00
4 WATT HT440 / 1 WATT EXPO UHF/PL	$195.00
5 WATT HT600 VHF 6F RAPID CHARGER	$445.00
25 WATT MAXTRAC 16F UHF SCAN	$495.00
45 WATT MAXTRAC 16F VHF SCAN	$495.00
75 WATT MSF5000 DUP MRTI TEST PAN	$4,995.00

SPECIALS

15W MAXTRAC TRNKD 800 B7 10 SYSTEM	$595.00
100W MICOR 4F PL UHF "AS IS" COMES WITH SUPER DUPER ACCESSORIES	$149.00
5W MX350 UHF 8F PL CHARGER "AS IS"	$195.00
50W SYNTOR UHF 8F PL "AS IS"	$295.00
60W MIDLAND BASE 39-50 MHZ PL	$395.00

WE BUY STX-MTX-MAXTRAC-MITREK-MT1000-SABER SYNTOR 9000-MOSTAR-MSR2000-MSF5000-SPECTRA

RADIO EXPRESS 703-266-1928 FAX 703-830-8710

Antenna Farm
11500 W. 90th St. • Overland Park, Kansas 66214
913-492-6212 FAX 913-492-2948

Cable • Connectors • Antennas • Installation Equipment

NEW **Selectone**

ST-20 Inversion Scrambler



The Selectone Model ST-20 is a microprocessor based, speach inversion voice scrambler used in secure two-way radio communication systems.

Applications for the ST-20 include commercial shared repeater systems and other land mobile configurations such a s marine radio systems where protection is desired from channel co-users and casual eavesdroppers.

$49.95

LOW PRICES • 1-800-255-6222 • FAST DELIVERY

Circle (116) on Fast Fact Card

CRYSTALS FOR ALL RADIOS

☐ **Communication Crystals**
All makes and models

☐ **Channel Elements**
Recrystalized and compensated

COMPETITIVE PRICING!

Emergency Service

800-333-9825

CAL CRYSTAL LAB, INC.

UNIDEN AMH300

Used-Like new condition
2 channel, Xtal controlled
VHF 148-174 MHz
Underdash mounting
Complete w/all accessories

$125 ea.

VersaTel

1-800-456-5548 Fax 307-266-3010



BUY — SELL — TRADE
2-WAY RADIO EQUIPMENT
MOTOROLA & G.E.

100Watt Bases/Repeaters/Mobiles
Service Monitors
No Pagers-Portables or Parts
Cash + Shipping Paid Promptly

Call For Quote or Sales List

Bob Barnett
Owner—WSRHL
FCC 1st Class Tech.
30 Years In Communications

Office (Nat'l WATS) (800) 423-3858
(501) 835-7066
FAX (501) 835-8766

BARNETT ELECTRONICS
8718 Wilhite Lane • North Little Rock, AR 72120

UNtenna



Low Profile Antenna for Radio Communication

Illustrated: Dual Band, VHF/UHF Model CR2/4A

FEATURES:
- Higher "Q" than whip antennas
- 95% Height reduction
- Models available from 27-900 MHz (HF, VHF, & UHF)

COM-RAD INDUSTRIES
Grand Island, NY 14072 • 716/773-1445
For Info RIGHT NOW, use your touchtone phone to call: 1-800-934-2FAX, Ext. 1001

Channel Elements
100,000 Freqs in Stock!
MITREK, MASTR II, MVP, EXEC II
MICOR, MOCOM & MOTRAC

$20 w/trade or $25 w/o trade
Lifetime Warranty
3-Day Standard Delivery

1-800-237-9654

CHANNEL ELEMENT HQ.
4120 Kirby Road
Cincinnati, OH 45223

We Buy Channel Elements.

ULTRA-COM 96



- LOW PRICE
- BIG SYSTEM PERFORMANCE
- DYNAMIC PROGRAMMABILITY
- MICROPROCESSOR CONTROL
- MULTI-FORMAT PAGING
- MANAGEMENT REPORTS
- PERSONNEL VEHICLE STATUS
- G-STAR INTERFACE
- E-911 COMPATIBILITY

Desktop dispatch console expands to 16 channels

MODULAR COMMUNICATION SYSTEMS

13309 SATICOY ST.
NORTH HOLLYWOOD, CA 91605
TEL. 903-860-3660 FAX 903-860-3658

Circle (117) on Fast Fact Card

Equipment for sale

GC GENERAL COMMUNICATIONS
MOBILE COMMUNICATIONS AUTHORIZED DEALER
#1 GE DEALER IN THE USA!
Largest Inventory — Quality Service
Fastest Delivery and Best Prices
VISA master card 1-800-356-3200
5157 Anton Dr.
Madison, WI
53719

Circle (118) on Fast Fact Card

Now, here's a switch!
CHARGEGUARD™
automatic ON/OFF timer switch for two-way radios, cellular phones
EASY TO INSTALL.
NO IGNITION SWITCH CONNECTION*
PROGRAMMABLE.
15 MINUTES TO 15 HOURS*!
MADE IN U.S.A.
NO MORE DEAD BATTERIES!!
PROTECT YOUR EQUIPMENT
FOR ONLY $74.95 MODEL CG-1000
CALL NOW FOR MORE INFORMATION*
ASK ABOUT OUR NEW DEALER KIT*
CHARGEGUARD
400 Highland Avenue
Altoona, PA 16602
800-458-3410

Circle (120) on Fast Fact Card

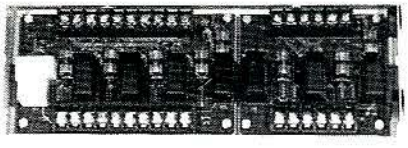
RCA • MOTOROLA • GE
MOBILES • BASES • PORTABLES • PAGERS • REMOTES
BUY • SELL • TRADE
PCI — PEKAAR COMMUNICATION INC.
Steve's back, formerly of Gregory Electronics Corp.
$ Specials of the month. $

GE Classic 800MHz, range trunking simplex model front mount only	$125
RCA Vee Tac MCA33AB11A mobile 150-170 range w/acc.	$125
GE Mastr Pro Base TX & RX power supply 4ET38A	$150
GE Mastr Pro RX AC power supply	$75
GE Phoenix N3D02 150-170 range crystal type	$135
GE Exec II RT64AAU33A 60w, mobile 42-50 range or 36-42 range w/cg & acc.	$135
GE Exec II RT74FEU23 100w mobile 36-42 range w/cg & acc.	$150
Johnson PPL6060-4 front mount mobile 450-470 range	$140
GE MPR or MPX rack charger	$70
GE PY or PE vehicular charger only	$20
GE Phoenix S model N5002 150-170 range synthesized	$200
GE Century II or Phoenix AC power supplies	$88

Catalog Available — If you can't find it, try us! — Call (201)772-0704
BOARDS • STRIPS • ACCESSORIES • ELEMENTS • REEDS

Circle (119) on Fast Fact Card

Central Communications, Inc.
AUXILIARY RELAY PANEL
For Public Safety Mobile Installations



◆ Saves three hours plus on initial installations; more on re-installations
◆ Eliminates under-hood mounting of relays
◆ More reliable than separate relays
◆ Simplifies Maintenance ◆ On board fusing
◆ On board surge and spike protection

For use with Motorola, G.E. and other low current switch panels in Public Safety Vehicles. Consolidates up to 8 relays onto a printed circuit board in one compact housing. Beacons, amber, flashing and alley lights plus trunk release, gun rack release and other items may be controlled.

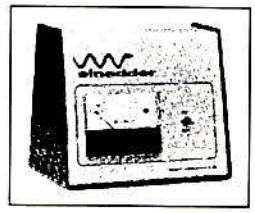
REPRESENTED BY
INTEGRATED COMMUNICATIONS
(509) 452-7836 • Dealer pricing available.

Circle (121) on Fast Fact Card

The Pouch
Tough, resilient black neoprene
More than 100 DEALERS Have a fit
About $11.00
A sturdy web belt-loop sewn on the back extends over the top and is secured on the front with a velcro tab.
The Pouch
It's Washable!
1-800-72-Pouch (Dealer Information)

ACTIVE FILTERS
AND
REEDS
FOR MOTOROLA PAGERS
FAST DELIVERY
Bramco
PH (513) 773-6255
P.O. BOX 1482, PIQUA, OHIO 45356

hi HELPER INSTRUMENTS COMPANY



Sinadder 1™
Your Complete Helper Distributor
CA Communications Associates Inc.
(800) 435-9313 In Illinois (800) 892-1611
Order Fax (800) 284-4934

Circle (122) on Fast Fact Card

Equipment for sale

For Sale
Centra Com I
Centra Com II
–Whole or in Parts–
Centra Com II
Reprogramming and
Custom Changes
Northeastern Communications Inc.
Waterbury, CT 06705
(203)575-9008

MECHEM ELECTRONICS

Visit our shop at 1003A Tyler Street in Fredericksburg. Direct all correspondence to our P.O. Box.

P. O. Box 7846 Fredericksburg, VA 22404 (703)373-3888

Portables
Synthesized MX's VHF & UHF some w/paging & DES options
P1068 Briefcase portable repeaters
P318BM1110A PT500 Packsets 30-36MHz
P1157MX Nicad Charger Discharger analyzer
MX MT HT Single and rack chargers
NLN7966B HT440/HT90 rapid chargers
Accors & Accessories in stock!

Mobiles
Syntors & Syntor X s VHF & UHF some w/DES
Syntor & Syntor X accessories siren, scan, multi PL etc
Mitreks, Micors, Memcoms etc
MCX100 s VHF some w/DES
VHF Widespace Micors w/aux. receiver
H14TTY3110A UHF Pac-it s

HFSSB Triton transceivers

Base Stations
B71RCB1126C 42-50 100w, Cont duty, 2F tone remote w/PL
Q2460B Martis EMS Memcom Base w/interconnect
Micor VHF Bases and repeaters
Spectra Tac Receivers and Comparators
T1600 Remotes some 8F, w/phone patch
Mastr II Bases 30-36 & 150-174
TDN6970A Page Entry Terminal
TCC807RV and VP II Lea- Siegler Scramblers

Misc.
Tek 5C & Tek 25 test panels
GE Test Sets
Mobile Duplexers
Misc. equipment—call with your needs!

Circle (123) on Fast Fact Card

Totally AWESOME
Low Band MITREKS
29-39 Mhz or 39-50 Mhz
110 Watts, Pl or Dpl, 1 or 4 ch.
CALIFORNIA RADIO 1-800-231-0103
395. 10 +
495. 1-9

BUY - SELL
RADIOS
NEW & USED
Johnson - Motorola
Standard - Uniden
Buy-Comm-Co.
Steven Kenney
1-800-347-4121
(602) 870-4121
FAX (602) 395-1357
2340 W. Columbine
Phoenix, Arizona 85029

EQUIPMENT FOR SALE
C74RCB6105 MICOR 403-430 MHz RPTR W/DVP
++MAXTRAX 800 w/SUBFLEET FROM $375
++MTX 800 PORTABLES FROM $575
++STX 800 PORTABLES AS LOW AS $575
10 MOT 900 MHz SPECTRA MOBILES FROM $400
MOT SPECTRA 900 MHz MANY MODELS TO CHOOSE FROM — CALL
PP1000:750:500:250 Cellular Interconnect —Call
4 MTX 900 PORTABLES FROM $650
1 MAXTRAX 900 MOBILE AS LOW AS $425
3 MOTOROLA SERVICE MONITOR R-1200
D35MJA77A3 MAXTRAX 15w, 6Frq. PL/DPL Conventional — $250
50 MOT MITREK 800 MHz CONVEN. MOBILES. 35W W/MDC & STATUS I.D. CLEAN — CALL
WANTED: MSR 2000 UHF RPTR'S
Call: Walter Marks
708-674-1799

GE 2-WAY RADIO
WHOLESALE
DISTRIBUTION CENTER

D&L CONNECTIONS
• Less than wholesale prices
• One million dollars of GE equipment
• Same day shipping
• Express Repair power
1-800-336-6825
ASK FOR Val
A DIVISION OF D&L COMMUNICATIONS, INC
3512 CAVALIER DRIVE • FORT WAYNE, IN 46808

Circle (124) on Fast Fact Card

Repair services

ACS *"The Pager Repair People"*
High quality, cost effective, and guaranteed pager repair. Flat rate labor (plus parts and shipping) on Motorola and NEC. **WE NOW SERVICE PANASONIC.**
(303) 337-4811

USED RADIOS
at Low Prices!
•MICOR •GE
•MITREK •RCA
•PORTABLES •ACCESSORIES
•MOCOM 70 TONE ELEMENTS
•MAXAR •CHRYSTAL ELEM
•RPTRS •BASE STATIONS
Large Quantities • (817) 433-5452

Repair services

PAGER/PORTABLE REPAIR
Low-cost conversion
Discounts for quantity
Pager Repair: Flat rate-$10 plus parts.
Portable Repair: Flat rate-$30/hr. plus parts. Maximum 2 hours.
Call **Pager Communications** for quotes: **1-800-955-1044**

TWO WAY RADIO REPAIR
Specializing in
REGENCY / RELM, WILSON, OTHERS
$25.00 / Hr. Plus Parts & Shipping
Fast Turnaround / Factory Trained
MULTICOM ***1-800-798-5842***
VISA MC *2412 N. Moore Ave., Moore, OK 73160*

SERVICE MONITORS
Specializing in Service Monitors since 1973
• Repair and Calibration
• Buy, Sell and Trade
COMMUNICATION INSTRUMENTS
356 Hillcrest Street, El Segundo, CA 90245
Phone (800) 288-8223 or (213) 322-3666

CUSHMAN SERVICE CENTERS
THESE ARE THE ONLY FACTORY AUTHORIZED CUSHMAN SERVICE CENTERS

TRITON ELECTRONICS, INC.	CUSHMAN	NS ELECTRONICS SERVICE, INC.
(708) 934-6426	(408) 432-8100	(404) 451-3264
FAX (708) 934-7195	FAX (408) 432-8359	FAX (404) 458-8785

CALL
(408) 432-8100 FOR FIXED PRICE REPAIRS
All Service Centers for New Model Demos and Literature

Circle (125) on Fast Fact Card

WE CAN SAVE YOU MONEY!

ALCOM Electronics Inc. METROLOGY DIVISION

ALCOM ELECTRONICS, INC. HAS A COMPLETE INVENTORY OF REFURBISHED FREQUENCY COUNTERS, DISTORTION ANALYZERS, SPECTRUM ANALYZERS, FREQUENCY SELECTIVE VOLTMETERS, TONE GENERATORS, SERVICE MONITORS, TRANSMISSION TEST SETS, MICROWAVE POWER METERS & SENSORS, SWEEP GENERATORS CHART RECORDERS, AND MORE...

FAX YOUR REQUIREMENTS OR CALL

1-800-476-2526 — 24 HOUR FAX LINE 601-868-0133

ALCOM ELECTRONICS, INC.

2801 17TH AVENUE, GULFPORT, MS 39501

WE TAKE TRADES ON NEW OR USED EQUIPMENT

IFR PRIORITY SERVICE AVAILABLE 24-72 HOURS

WE CARRY A FULL LINE OF TELECOMM INSTRUMENTS

RYCOM

FREQUENCY SELECTIVE VOLTMETERS

METRO TEL/DDI

TRANSMISSION TEST SETS

DROP & INSERT

T1, DS1, DS2

DS3 & DS4

AVCOM

SPECTRUM ANALYZERS

WECO, CABLES AND ADAPTERS, BANTAM ADAPTERS, AND MUCH, MUCH MORE...

1.0 GHz PORTABLE SPECTRUM ANALYZER



MODEL #2610

- 1 MHz TO 1 GHz FREQUENCY COVERAGE
- FULLY PORTABLE FOR FIELD SERVICE
- DURABLE, METAL CASE CONSTRUCTION
- WEIGHS LESS THAN 20 LBS.
- MEASURES ONLY 4.5 x 11.8 x 13.4 INCHES
- 12VDC INTERNAL RECHARGEABLE BATTERY OR 12-15VDC EXTERNAL SOURCE OR AC POWER
- UP TO 1 HOUR BATTERY OPERATION AFTER 2 HOUR RECHARGE
- AUDIBLE LOW BATTERY INDICATION
- BANDWIDTH SETTING AT FIXED (1 MHz) LOCKS 3 dB BANDWIDTH AT 1000 KHz REGARDLESS OF SCAN WIDTH SETTING — IDEAL FOR OBSERVING VIDEO/TV/CATV SIGNALS
- SWITCH SELECTABLE 50Ω/75Ω INPUT
- FIELD CALIBRATIBLE USING INTERNALLY GENERATED 100 MHz, 80 dBμV* SIGNAL
- PERMANENTLY ATTACHED ACCESSORY POUCH

ALL TYPES OF EQUIPMENT AVAILABLE

HEWLETT PACKARD

TEKTRONIX

IFR

KIPP & ZONEN

CUSHMAN

MOTOROLA

MARCONI

JFW ATTENUATORS

ADC

PACE

B & K

FLUKE

WEINSCHEL

WAVETEK

BOONTON

GENRAD

OPTOELECTRONICS

AND MANY, MANY MORE...

WE REPAIR AND CALIBRATE ALL MAJOR MANUFACTURER'S TEST EQUIPMENT FROM **DC TO MICROWAVE**

ALCOM IS A FULLY STAFFED LAB THAT IS **N.I.S.T. TRACEABLE** AND MEETS THE CALIBRATION SYSTEM REQUIREMENTS OF **MIL-STD 45662A**

A MEMBER OF THE **NATIONAL CONFERENCE OF STANDARDS LABORATORIES**

Circle (126) on Fast Fact Card

ALCOM Electronics Inc. METROLOGY DIVISION

ALCOM Electronics Inc. METROLOGY DIVISION

Repair services

D&L RED Repair Express Depot

- Flat rate pager repair
- Recrystalling & programming
- BRAVO display replacement
- Quick turnaround
- Volume discounts
- Call for competitive pricing



D&L RED Repair Express Depot

3512 Cavalier Drive Fort Wayne, IN 46808
(219) 484-0466 FAX (219) 483-5584

A DIVISION OF D&L COMMUNICATIONS

Circle (127) on Fast Fact Card

$25/HR* 2-WAY REPAIR MOBILES & PORTABLES
Motorola, Uniden, Standard, Johnson, Midland and many more!
A.S.K. COMMUNICATIONS
1-800-827-0747
3837 E. Wier Ave., Suite #1, Phoenix, AZ 85040
*Plus parts & shipping

Computer software

Use Mobile Radio Technology Classified Ads

Computer software

Computer Software for Communications Engineering Applications

VHF/UHF Land Mobile Radio Engineering Programs
- Predicted Area Coverage, Shadow, & Field Strength Models
- FCC Carey Curve Contour Plotting and Reports
- Point to Point Link Analysis and Path Profiles

Microwave Engineering Programs
- Path Analysis and Profiles
- Quadmap Crossover Points

3 and 30 Second Digitized Terrain Elevation Data
- CD-ROM and Floppy Diskette



ROCKY MOUNTAIN COMMUNICATIONS, INC.
2023 Montane Drive East ■ Golden, CO 80401-9124
(303) 526-5454 Fax: (303) 526-2662
CALL TODAY FOR YOUR FREE DEMO DISK!

Real World Propagation[TM] Studies
- On-Line Services
- FCC and FAA Data Files for PC
- 3 Second Terrain Data on CD-ROM

Richard L. & Richard P. Biby, Principals

Communications Data Services, Inc.
6105-F Arlington Blvd • Falls Church, VA 22044
(703) 534-0034 • Telefax (703) 534-7884

Pager/Message Center Software
TRACKS EVERYTHING
Available for Lease or Purchase
Billing • Inventory
People • Commissions
Rentals, Mobiles, Voice Mail
TAS, Reports & More
BURKE COMMUNICATIONS
742 N. Taylor, Oak Park, IL 60302
708-383-8580 FAX 708-386-1336

Computer software

CyrNet

"Near paperless" service shop software for PC networks and multitaskers. Self pricing service tickets, inventory, accounts receivable, recurrent and airtime billing Zetron billing included, other airtime modules available.

Full BBS Support
Connect 703-268-9767
(300 to 2400, N, 8, 1)

TURBEX Z
Systems and Supervisory Control, and Data Acquisition Via Packet Radio using Zetron remote terminal units.

Seeking system integrators for the western united states for the water quality, wastewater and agricultural and security markets. A prime expansion area for qualified integrators.

IMSITE, SITEPRO
Intermodulation, graphics, path for P.E. and tech.

Engineering and Technical software for Professional Engineers, Technicians and Two-Way Shops. The worlds fastest Intermodulation PC programs...no exceptions. Toolbox and Major Application Software.

FULL BULLETIN BOARD SUPPORT
CALL:
CYBERSYM CONTROL SYSTEMS
P.O. Box 227
Blacksburg, VA 24063
703-268-5400 VOICE
703-268-9767 BBS

Circle (128) on Fast Fact Card

Your ad could be HERE
for just $69
Call or fax
Carla Gamino
(303) 762-1249
FAX (303) 762-0069

Classified

Computer software

Congratulations New Motorola Dealers !!

While the opportunities of a two-way radio dealership can be almost limitless, so can the challenges. As a full-line Motorola dealer, your success depends on conquering challenges and seizing opportunity.

At ***Micro-Quick Systems***, we have helped hundreds of cellular and two-way sales / service organizations get a handle on their business, through our intelligent and highly integrated software solutions.

We can provide solid tools for telemarketing, lead tracking, quote generation, credit approval, sales and service order entry, inventory control, bar-coding, automatic warranty and maintenance contract billing, accounts receivable, accounts payable, payroll, general ledger and recurring billing (SMR, PCP, cellular, reseller etc.).

We can also provide complete turn-key multi-user computer systems, installation, on-site training and leasing.

For information, call us at either (800) 874-7749 or (714) 980-1034.

We'll quickly show you how to turn challenges into **OPPORTUNITY**.

Circle (129) on Fast Fact Card



SoftWright
791 South Holly Street
Denver, Colorado 80222
(303) 329-6388
FAX (303) 329-0901

Terrain Analysis Package (TAP)™
PC-based software for RF studies

- Area field strength coverage maps.
- Shadow maps.
- Choice of propagation models.
- Point-to-point/microwave fade margin and reliability calculations.
- User-customized data base for buildings and vegetation.
- Digital elevation data on floppy disk or CD-ROM.
- Intermodulation product studies.

Free demo disk upon request.

Billing and Management Information Systems

- Airtime Billing
- Proven Functionality
- Single-User To Multi-User
- Financial Accounting
- Support Responsiveness
- Know Us By Our References

DBC SOFTWARE, INC.
....providing quality software for the Radio Industry.

3200 Wilcrest, Suite 350
Houston, TX 77042

713-785-1477
FAX: 713-785-1054

Circle (130) on Fast Fact Card

Computer Resources Inc.
The Service Management system is designed for the management of a mobile communications company. It provides the user with work orders, and work order history, inventory control and purchasing, contract management and costing, equipment management and costing, and technician productivity. Also available are Recuring Billing, SMR Billing, Pager Billing and Inventory, plus Accounts Receivable, Accounts Payable, General Ledger, and Payroll.
205/591-8810

Circle (131) on Fast Fact Card

Rentals

MOTOROLA
RADIO RENTALS

- MT1000, HT600, P200
- Intrinsically Safe
- All Types Headphones
- Mobiles & Portapacks
- Repeaters & Crossband Sets
- Dealer Inquiries Invited

1-800-283-COMM
EVENT RENTAL COMM., INC.

MOTOROLA RENTALS
- *NEW!!* GP 300
- P200, HT600
- Mobiles, Repeaters
- Dealer discounts
- Commissions paid

1-800-767-1963
MOSS COMMUNICATIONS

Cellular services

PHILA., PA., SO. JERSEY
$250.00 Commission
METROPHONE
Professional on-site installation ... $125
Warranty service on all brands.
ADVANCED CELLULAR OF PHILADELPHIA
800-233-0013 • IN PA 215-322-4600

Computer software

COMPUTER ENGINEERING OF MICROWAVE SYSTEMS
(CEMS)

LAND MOBILE RADIO COVERAGE
(LMRC)

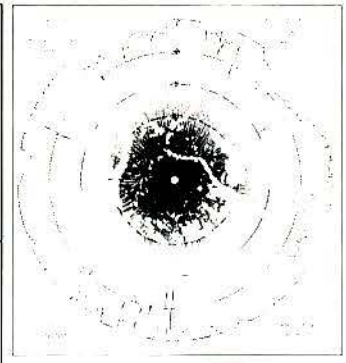
3 Second Terrain Data

MICROWAVE

- Menu Driven - Color Coded
- On-Screen Path Profile Design
- Diffraction Loss Calculations
- Reflected Signal Analysis
- Route and System Diagrams
- Map Crossings - Graphic with Dimensions
- Performance Predictions - Analog, Digital and Video

LAND MOBILE RADIO

- Coverage Diagrams
- Multiple Prediction Models
- 360 Radials - 50 Mi (80 Km) Radius
- Relief Maps in Color
- Intermodulation Calculations
 - 300 Tx and Rx Frequencies
 - Up to 9th Order
 - Graphic Presentations



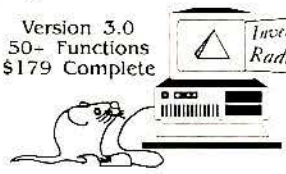
NORTON ENGINEERING
10002 McDuff Court
Vienna, VA 22181
703) 938-5745
Fax: (703) 938-9168

Demo Disk
and
Sample Printouts
Available

Circle (132) on Fast Fact Card

Pyramid Communications Service Management Software

Version 3.0
50- Functions
$179 Complete



Free Demo
& Manual

210 Main St #153 Seal Beach CA 90740 (310) 430-5892

TCS

CONSULTING SERVICES

- Feasibility Studies
- Path Analysis
- Specifications
- License Assistance

ENGINEERING AID SOFTWARE

- Microwave Calculations
- Multi-Point (SCADA)
- Topo-Graph (Profiles)
- HAAT Calculations

30 Second & 3 Arc Second Data Bases Now Available

TECHNICAL COMMUNICATIONS SOFTWARE

P. O. Box 884 Montgomery, TX 77356 • (409) 588-3200 • FAX (409) 588-4434

RADIO SYSTEM DESIGN

Computer Software for PC's

- Digital Topography - 3" and 30"
- Geographic Boundaries
- Demographic Analysis
- 3-D Displays
- Radio Coverage
- Path Profiles
- Full Range of Design Options

J M A - Applied Spectrum Research

2975 Valmont #100 Boulder, CO 80301 USA
303 444 4871 FAX: 303 444 4872

COMMUNICATIONS SITE SPECIALISTS.

- Site Selection, Acquisition, Development, Construction, Engineering, Management, Marketing.
- Sites Available Now ... IL, IN, MA, MD, MI, MO, NC, OH, TX, & VA

RAM

FACILITIES MANAGEMENT, INC.

10 Woodbridge Center Drive, Woodbridge, NJ 07095
(908) 636-6970 • FAX (908) 636-7260 • Toll-Free (800) 247-4796

© 1991 RAM Facilities Management Inc

Circle (133) on Fast Fact Card

For Classified
Advertising Information
Call Carla Gamino at (303) 762-1249

Tower space

TOWER SPACE
NEW ENGLAND AREA

Foxboro, MA: Lat. 42-05-43, Lon. 71-13-52
AGL 465' AMSL 865'
Kingston, MA: Lat. 41-57-45, Lon. 71-43-01
AGL 468' AMSL 728'
Medford, MA: Lat. 42-25-51, Lon. 71-05-22
AGL 350' AMSL 538'
Johnston, RI: Lat. 41-48-12, Lon. 71-33-27
AGL 490' AMSL 990'
Hopkinton, RI: Lat. 41-29-41, Lon. 71-47-05
AGL 564' AMSL 949'
Farmington, NH: Lat. 43-21-16, Lon. 71-04-19
AGL 592' AMSL 1600'

SOUTH FLORIDA TALL TOWER

Miami, FL: Lat. 25-58-15, Lon. 80-12-32
AGL 1044' ASML 1049'

Industrial Electric & Electronics, Inc.
100 Marion Drive
Kingston, MA 02364
CONTACT: DAVE FENTON
1-800-323-7212 Outside Mass.
1-800-696-9109 Mass. Only



STAN STANN

TEL: (708) 823-7713

COMMUNICATIONS TOWER & ANTENNA SITES FOR THE METROPOLITIAN CHICAGO AREA

P O Box 31160
CHICAGO IL 60631

SEATTLE AREA

Commercial power with generator backup.
Good security. Year around access.

GOLDSPAR COMMUNICATIONS
206-588-3459
Fax 206-581-2205

TOWER SPACE
Microwave Tower Route
Minneapolis, MN to Omaha, NE - 12 sites
QUAD STATE TOWERS AND COMMUNICATIONS
507-283-8042

Tower space

UNBELIEVABLE RADIO SPACE AVAILABLE!

You'd be *crazy* not to look at the only site in downtown Boston that **CAN HEAR** has **NO INTERMOD** and **GUARANTEES IT IN YOUR LICENSE AGREEMENT.** 1.3 miles away and at 723' its **ONLY** 53' shorter than the Prudential and has precabled telco & emergency power, air cond., 24 hr access, good lighting, fiber and more.

CALL NOW, YOU'LL BE IMPRESSED.

Lat 42° 21' 08" Long 71° 03' 25"

Skyline Antenna Management, Inc.

Call Peter Kovaleski, 203-684-4444

Circle (134) on Fast Fact Card

NEED TENANTS??

Advertise your sites in the

NATIONAL COMMUNICATIONS SITE DIRECTORY

Dedicated to advertising antenna sites for lease

NEED SITES?

Then NCSD contains hundreds of prime antenna sites across the Nation.

To get your copy write or call:

INTRAFAM, Dept. M, P.O. Box 6093

Freehold, NJ 07728 (908) 462-5964

37 CALIFORNIA ANTENNA SITES

• Major Locations • Stand-by power
• Secure facilities • Air Conditioning



Or develop your own site.
Land available at
Oat Mountain/Chatsworth.

MERIDIAN COMMUNICATIONS

Since 1956

23501 Park Sorrento, Ste. 213A
Calabasas, CA 91302-1355
Contact Rich or Jack Reichler at
818/888-7000

PRIME NORTHERN NEVADA SITES

Our newest, Pond Peak, at 8035' AMSL 2635' AAT, Overlooking Reno and Fallon and the I-80 corridor,

CALL NOW, **702-827-6060**

HIGH COUNTRY COMMUNICATIONS

TOWER SPACE FOR RENT IN ILLINOIS

Springfield — 48" face and 430 ft. ht.
Champaign — 36" face and 334 ft. ht.
Clifton — 30" face and 304 ft. ht.

CONTACT BILL YOUNG
(815) 457-2195
TRAD INC.
205 E. RAILROAD AVE.
CISSNA PARK, ILL. 60924

TOWER TECHNOLOGY CORPORATION

We have the finest, professionally managed antenna sites in Florida, Master Antenna System to UHF & 800 MHz using 3⅛" hard line. For window tower top amp. If you need antenna space in:

Jacksonville • Tampa Bay • Sarasota/Venice
Lakeland • Disneyworld/Kissimmee/St. Cloud

Contact: Bruce McIntyre

(813) 854-1518, 105 H Dunbar Ave.
Oldsmar, FL 34677; FAX: (813) 855-1969

ARIZONA'S PREMIER TOWER FACILITIES

Contact Dave or Charlie Bonifasi

ANTENNA SITES, INC.
602-451-7702

TOWER SPACE

Victorville at 4482 and Barstow, CA at 3325 feet.
MICROWAVE CIRCUITS BETWEEN SITES.

CALL NOW: (818) 308-0398
FAX: (818) 308-3909

AURORA, IL

40 miles west of Chicago

41° 45'29"N 88°18'55"W
AGL 638 to roof 243'

Space available on towers. 95' above roof level & 40' above roof. Space also available for new towers or at roof level.

Call Gordon Wetherholt
Fox Island Place

(708) 897-6055

FT. MYERS—NAPLES FLORIDA AREA

New 800' foot tower now being built midway between Ft. Myers and Naples in Bonita Springs. Tower will offer excellent coverage of these rapidly expanding markets. Limited space available.

INTERESTED PARTIES REPLY TO:

TOWER
P.O. BOX 2845, FT. MYERS, FL 33902

Equipment wanted

Pagers Wanted

PANASONIC & MOTOROLA
☆New ☆Used ☆Refurbished

Perfect Communications
1-800-666-1668

EQUIPMENT WANTED!!

MOTOROLA

"Metropage or Modax Plus +"
Paging Terminal Complete

Contact: Nick Powell
Florida Power & Light
904-239-5926

WANTED

dead or alive

MOTOROLA P200 radios

ONLY

call COLLECT
(813)-977-5470

WANTED 35 MHz PAGERS

WANTED 35 MHz
MOTOROLA
Transmitters, PURC/Compa
Also, 900 MHz Repeaters
1-800-638-9969
Ask for Ext. #18

Equipment Wanted

Motorola, Johnson, GE,
EFJ, Uniden, Standard

Buy-Comm-Co.
1-800-347-4121
FAX (602) 395-1357

WANTED

Used GE Trunked Mobiles and Stations
TMX-8210, TMX-8310, TMX-8510,
GE-MARC V Stations.
Call John Peacock
800-232-7715

WANTED

Motorola Pocket TX's, Portable Receivers and Recorders. Alarm TX's, Cisco's, Bell & Howell/Kel Equipment AID - Audio Intelligence Devices Equipment, OAR.

Contact: Michael Adler
Sherwood Communications Assoc.
215-357-9065

WANTED

Midland E/Prom Programmer,
Model 70-1000
Working or Non-working

205-698-9059

Services

FCC

REAL TIME ACCESS •
DISKETTES •
9 - TRACK TAPES •
CUSTOM REPORTS •
LABELS •
PROSPECT LISTS •
RADIUS/DISTANCE SEARCHES •
REGIONAL UPDATE SERVICE •

THE MOST CURRENT FCC DATA AVAILABLE TO THE PUBLIC

- Part 90
- Part 95
- Part 22

} *Granted and Pending*

- Part 68 *Telephone Interconnect*
- FCC *Administrative System*
- MDS *Multipoint Data*

ATA Services
(703) 838-1900

SOLICITATION OF FIRMS FOR A TWO-WAY RADIO SYSTEM BIDDERS LIST

The NYCDOT is developing a Bidders List for the exclusive use of:

- 10 trunked channels of radio spectrum capable of supporting 1,200 request-to-talk (RTT) mobile radios;
- 250 full featured (without telephone interconnect) push-to-talk (PTT) portable/mobile radios; and
- 20 units worth of AVL data.

The successful bidder must provide (8) CRT consoles capable of transit dispatch functions and (2) incident screens capable of displaying schedule adherence information received from (20) GPS AVL receivers.

This bid is for an all inclusive 15 year contract to supply equipment and use of spectrum/fixed-end equipment.

For applications, please send a self-addressed stamped (8"×11") envelope to:

New York City Department of Transportation
Bureau of Transit Operations
253 Broadway, Room 501
New York, NY 10007
Attn: Ms. Claire Spielberg

SAVE TIME

For fast, accurate service, please remove the Peel-Off Label (which is used to address your magazine) and affix it to the Fast Fact Card, the Address Change Card, or to any correspondence you send us regarding your subscription.

MOBILE COMMUNICATIONS
Technician Instruction

38 lessons and tests written exclusively for Mobile Communications servicing.
No Radar or TV Lessons.
Home Study Course $375.
Time Payments Available.

MTI
Established 1960

Mobile Training Institute
528 Pacific Terr., PO Box E
Klamath Falls, OR 97601
(503) 882-5408

HT600/P200 2 ch to 6 channel
CONVERSION $40.00
Out of Band Modifications for
Radius Portables and Mobiles
Metrocom 718-392-3300

DUPLEXER TUNING
Minimize your Losses
Maximize your Gains

D P ELECTRONICS, INC.
152 Floyd Avenue
Bloomfield, NJ 07003
(201) 748-6334

FCC License Preparation
Fast, Easy, Home Study, Inexpensive.
Top Jobs — Top Pay $$$
Audio & Video Courses Available.
FREE Details
WPT PUBLICATIONS
1-800-800-7588

USE MOBILE RADIO TECHNOLOGY CLASSIFIED ADS

Accessories

PAGER LABELS
Complete In-House Graphics Service
SeriSystems
172 METRO PARK, ROCHESTER, NY 14623
1-800-457-7374 FAX (716) 272-5525



For Classified Advertising Information Call Carla Gamino at (303) 762-1249

Ad index/hotline

Company	Page Number	Fast Fact Number	Advertiser Hotline
Alcom Electronics Inc.	98	126	800-476-2526
Alexander Batteries	38	32	515-423-8955
The Antenna Farm	95	116	800-255-6222
The Antenna Specialists Co.	IFC	1	216-349-8400
Astron Corp.	39	33	714-458-7277
Automation & Electronics Engr. Inc.	92	109	800-527-4596
Barnett Engineering	58	54	800-268-2646
BEE Electronics, Inc.	87	91	708-345-0337
Berry Controls, Inc.	94	114	412-746-8888
Bird Electronics Corp.	83	83	216-248-1200
Bomar	34,90	28,105	800-526-3935
California Radio	91,92		800-231-0103
Carlson Communications	46	40	800-283-6006
Celwave	11	10	800-321-4700
Centurion International Inc.	31,94	24,115	800-228-4563
CES, Inc.	7	7	407-679-9440
Chargeguard Corp.	96	120	800-458-3410
Cimarron Technologies	14-15	13	800-487-7184
Coded Communications	24	20	800-228-6367
Communications Specialists	BC	3	800-854-0547
Communications Associates	96	122	800-435-9313
COMTELCO Industries, Inc.	72	67	708-790-9894
Connect Systems, Inc.	19	16	800-545-1349
Control Signal Corp.	12	11	303-989-8000
CPI Communications, Inc.	82	81	800-869-9128
CTI Inc.	72	68	601-287-8081
Cushcraft/Signals Corp.	43	37	800-258-3860
Cybersym Control Sys.	99	128	703-268-5400
DataCom	56	50	217-222-0160
DATARADIO Corp.	74	70	404-392-0002
Data Signal, Inc.	68	63	912-883-4703
DBC Software, Inc.	100	130	713-785-1477
DB Mobile	47	41	800-388-2112
Decibel Products, Inc.	36,37	30,31	214-631-0310
D & L Communications, Inc.	99	127	219-484-0466
Doppler Systems, Inc.	84	86	602-488-9755
Eagle Wichita	58	53	316-942-5100
EDX Engineering, Inc.	76	72	503-345-0019
General Communications	96	118	800-356-3200
GLB Electronics	60	56	716-675-6740
Hark Electronic Systems, Inc.	71	66	800-FOR-HARK
Hewlett Packard	77	73	509-921-4001
HM Electronics, Inc.	27	22	619-535-6060
Hutton Communications	78,79	75,76	214-239-0580
HY-Q International	91	106	606-283-5000
IFR Systems, Inc.	41	35	316-522-4981
Integrated Communications	96	121	509-452-7836
Interconnect Specialists, Inc.	42	36	407-332-0533
JFW Industries, Inc.	50	44	317-887-1340
Kenwood U.S.A. Corporation	49	43	213-639-4200
Larsen Antennas	75	71	206-573-2722
Leathersmith	84	85	717-270-2910
Logotronix, Inc.	91	107	800-442-4887
Magellan Systems Corp.	73	69	714-394-5000
Magnasync	60	57	213-962-0382
Maxon America, Inc.	57,86	52,88	816-891-6320
Maxrad, Inc.	29	23	708-595-3933
McManus Communications	93	111	501-763-6250
Mechem Electronics	97	123	703-373-3888
Meridian Communications	59	55	818-888-7000
Micro-Quick Systems, Inc.	100	129	800-874-7749
Midian Electronics, Inc.	32F	27	602-884-7981
Midland International LMR	40	34	800-MID-LAND
Mobile Mark, Inc.	8	8	800-648-2800
Modular Comm. Systems	95	117	903-860-3660
Motorola Government	51	45	800-543-9191
MX-Com, Inc.	9	9	919-744-5050
NEC America	13	12	214-907-4000
New Mar	87	90	714-751-0488
Norcomm Corp.	80	78	916-477-8400
Northern Controls & Comms	26	21	907-452-7765
Norton Engineering	101	132	703-938-5745
NS Electronics	97	125	408-432-8100
Orbacom Systems, Inc.	45	17	609-829-4455
Pekaar Communication, Inc.	96	119	201-772-0704
Polyphaser Corp.	81	79	800-325-7170
Primus Electronics Corp.	92	110	800-435-1636
RadioMate	90	104	800-346-6442
RCW Distributing	94	113	800-726-9015
Rocky Mountain Comms., Inc.	99		303-526-5454
Santa Fe Distributing	70	65	913-492-8288
Scala Electronic Corp.	67	62	503-779-6500
Schlumberger Technologies	17	15	800-225-5765
Securicor PMR Systems, Ltd.	66	61	
Securitron Company	18	14	408-263-6434
Selectone Corporation	48	42	510-887-1950
Setcom Corp.	23	19	415-965-8020
Shinwa Communications of Am	52	46	800-627-4722
Shure Brothers, Inc.	32E	26	800-25-SHURE
Sigtone, Inc.	54	48	800-525-8663
Sinclair Radio Laboratories	53	47	800-288-2763
Skaggs Telecomms Service, Inc.	63	59	801-261-4400
Skyline Antenna Mgmt.	102	134	203-684-4444
Softwright	100		303-329-6388
Solar Electric Specialties	87	89	707-459-9496
Solid State Communications	3	5	415-785-4610
Sonic Communications, Inc.	86	87	603-878-1944
Southern Computer Corp.	90	102	800-752-3571
Standard Communications	65,93	60,112	800-767-0204
Standard Communications	90	103	800-800-9825
Sti-Co Industries, Inc.	44	38	716-662-2680
Tad Radio	80	77	509-326-1511
Tait Electronics	69	64	
Transcrypt International, Inc.	5	6	402-483-2961
Trident Micro Systems	61	58	800-798-7881
Unipage	35	29	800-367-2864
VCP International, Inc.	82,83	82,84	800-527-9366
Vega, A Mark IV Company	1	4	818-442-0782
Vocom Products Corp.	81	74	800-USA-MADE
WAVETEK	55	49	800-245-6356
Brian R. White Co., Inc.	56	51	707-462-9798
W & W Associates	32A	25	718-961-2103
Yaesu USA	IBC		213-404-2700
Zetron Inc.	22,85	18,39	206-820-6363

vertex™

The Perfect Line.

The new 99-channel **Vertex** mobile (FTL-2011/7011-99) gives you the perfect line. This mobile radio is the latest addition to the growing **Vertex** line and another example of Yaesu's total commitment to quality, reliability and innovation.

The new 99-channel mobile radio meets the same exacting MIL STD 810 C/D specifications and strict quality requirements as the other **Vertex** models, including the popular 4-channel and 12/24-channel versions. All of which are available in UHF, VHF and Lowband Frequency Ranges.

Delivering powerful features, Wideband Frequency Spread and simple operation, **Vertex** mobile radios are the choice of police and fire departments, government agencies, construction companies, forestry services and other demanding customers. In addition to the long list of standard features of the **Vertex** product line, the 99-channel model also has Digital Coded Squelch, Alpha Numeric and the most popular signaling formats built in as standard.

See for yourself why **Vertex** is the perfect line. Contact your nearest Yaesu USA dealer today.



YAESU U.S.A.

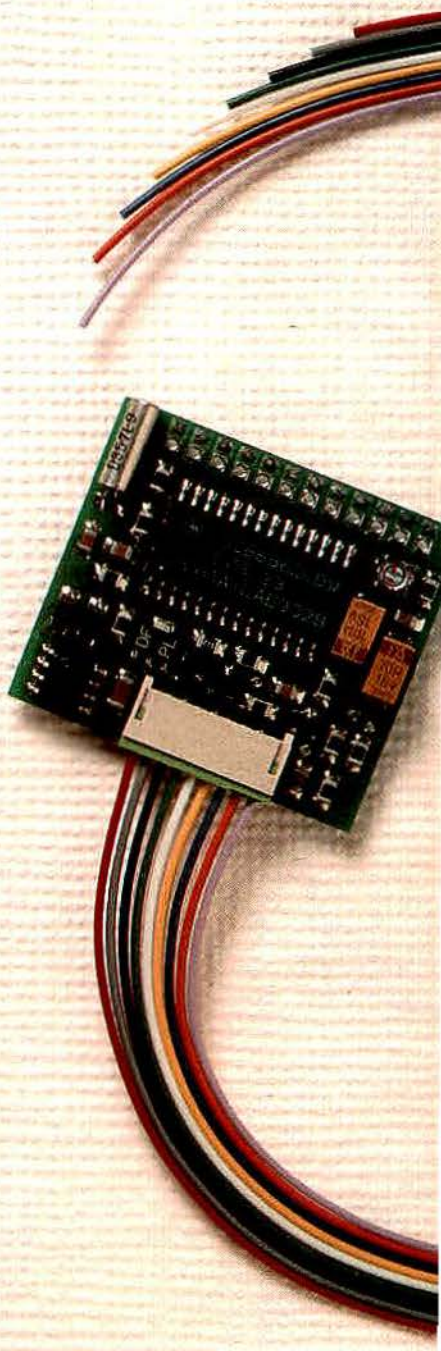
© 1990 Yaesu USA, 17210 Edwards Road Cerritos, CA 90701

Specifications subject to change without notice.

DCS-23 Microminiature DCS Encoder-Decoder

Compatible with all digital continuous tone coded squelch systems used in Land Mobile radios such as: "Digital Private Line", "Digital Channel Guard", "Digital Call Guard", etc.

- Microminiature in size, 1.36" x 1.18" x .25" to fit inside all mobile units and most portables
- Totally immune to RF
- Uses crystal controlled CMOS microprocessor for low voltage operation
- Three pole high pass filter included to remove tone from received audio
- All connections made with microminiature plug and socket with color coded wires attached
- Double sided tape supplied for quick mounting
- All industry standard digital codes are field programmable with simple PCB jumpers
- All 512 octal codes can be programmed
- Simple field programming of both transmit and receive data polarity
- Operates over full temperature range of -30°C to +65°C
- Easy hookup with external diodes for multi-code encode or decode
- Powered by a very low voltage of 6vdc to 20vdc @ 8ma.
- Full one year warranty when returned to the factory for repair
- Immediate one day delivery



Decode

- Sensitivity better than 15mv
- A signal to noise ratio of better than 4db Sinad reliably operates decoder
- Decode time is 171ms (one word length)
- Decode input Z is 60k, AC coupled, for easy discriminator hookup
- Open collector transistor muting can be programmed for ground to enable or ground to mute
- Automatic hookswitch monitoring when mike is removed from hanger
- Automatic squelch tail elimination by turn off code detection

Encode

- Golay 23 bit digital word sent at 134.4 Hz data rate
- Turn off code of 134.4 Hz sine wave for 180ms sent to eliminate receiver squelch tail
- Output Z is 2.2k, AC coupled, and adjustable from 0-3v
- Open collector high current transistor for P.T.T. keying
- Test code to set transmitter modulation level included

$59.^{95}$ each

COMMUNICATIONS SPECIALISTS, INC.
426 West Taft Avenue • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. 1-800-854-0547

Circle (3) on Fast Fact Card